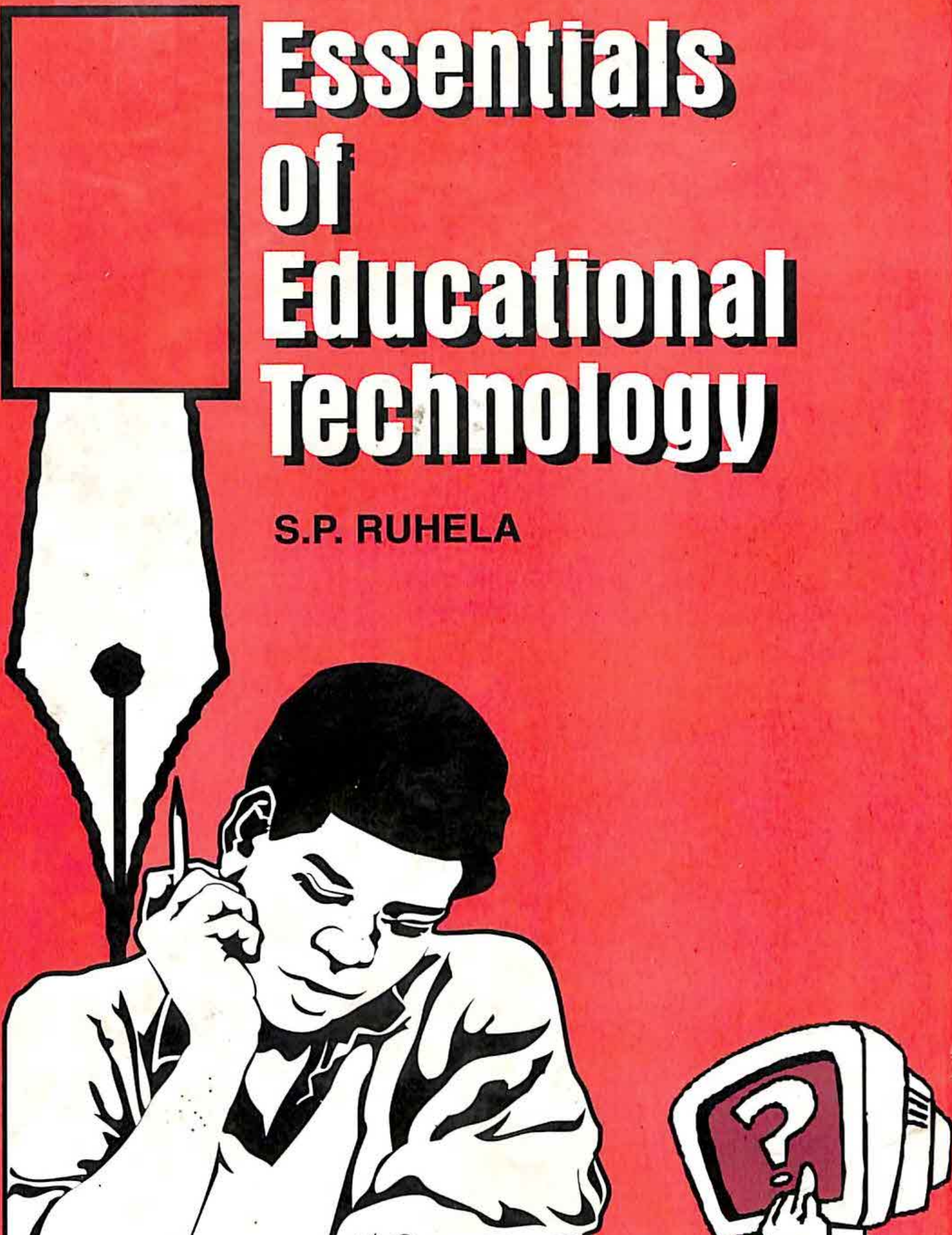
Essentials of Educational Technology

S.P. RUHELA



ESSENTIALS OF EDUCATIONAL TECHNOLOGY

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OF
EDUCATIONAL TECHNOLOGY

(Text book for B.Ed. & M.Ed. Students)

By

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FOREWORD

I have great pleasure in writing this Foreword to this book of EDUCATIONAL TECHNOLOGY written by my friend Dr. Satya Pal Ruhela. Dr. Ruhela needs no introduction. He has carved out for himself a well-deserved recognition as a creative researcher, writer and teacher in the emerging field of sociology of education in India. For about two decades, Dr. Ruhela had contributed richly to the school and college education in Rajasthan, and since 1966 he has been doing a lot of work in the sociology of education, which has a direct bearing on the problems of the school teachers and their profession. His books and research papers are known for their clarity, systematization and insight into the live problems of education and society in India. These qualities are reflected in this book also.

Education Technology is yet in its infancy. Even in the U.S.A. the U.K. and Japan this has not grown as a fully developed field of study. There has been a great deal of emphasis on the contents borrowed from the psychological of learning and teaching in it. This in itself is a lop-sided development. The sociological aspects of learning and teaching must invariably supplement the psychological aspects of these processes involved in any meaningful education. Dr. Ruhela, being a sociologist of education, has rightly tried to emphasize this important point in the present book. I hope teachers and students of education shall greatly benefit from this publication.

The teaching-learning process in an old, culturally diversified and socially stratified society like our's is bound to be affected by a large number of cultural, social, economic factors apart from the psychological and administrative factors. Although we do get inkling of these factors in this booklet, also we very much wish to have a detailed exposition of these factors in some book, paper or next edition of this book by a competent sociologist like Dr. Ruhela.

The amount of labour put in and the insight shown by Dr. Ruhela in mastering this new field and preparing this basic text for students, teachers and teacher-educators deserves all appreciation.

(Late) Prof. L.K. Oad
Principal,
B.V. College of Education,
Banasthali Vidhyapith,
(Rajasthan)

PREFACE

Educational Technology is a comparatively new field of education. In our country this has been introduced during the last three decades only. This has helped in the understanding how class teaching can be effectively organised with the help of principles of psychology, sociology, management and allied social sciences. This has helped in the overhauling of the process of teaching and learning in India.

Since it a subject taught to all B.Ed. and M.Ed. students all over the country these days, it is necessary to provide straightforward, meaningful and comprehensive materials to the teachers under training. It is with this practical point of view that this book "ESSENTIALS OF EDUCATIONAL TECHNOLOGY" has been prepared.

It is hoped that this will of great use to all teachers under training as well as practising teachers in schools.

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CHAPTER 1

EDUCATIONAL TECHNOLOGY AND INSTRUCTIONAL TECHNOLOGY

Section 1: Introduction

During these days of scientific, industrial and technological development, we hear about various kinds of technologies, e.g. mining technology, glass technology, food technology, petrochemical technology etc. Of late, we have started hearing about "Educational Technology", "Technology of Education", "Instructional Technology" etc.

It is rather surprizing to find that although their use in educational world is becoming more and more fashionable these days, yet not many people donot really understand their correct meanings or implications with the result that a lot of confusion surrounds them.

Some old conservative teachers and educationists are alarmed at the use of such new terms in the field of education, and they are opposing their popularity tooth and nail without, of course, showing patience to understand them and judge their significance.

In this chapter, we wish to clarify the meaning, implications and significance of "*Educational Technology*", and show how it differs from another term "*Instructional Technology*". Let us, in the very beginning, make it clear that "*Educational Technology*" and "*Technology of Education*" mean the same thing and so they are synonyms. As such, we have to clarify the differences between

"*Educational Technology*" (briefly stated as E.T.) and "*Instructional Technology*" (briefly stated as I.T.)

Section II : Educational Technology

Before trying to understand what Educational Technology is, let us discover the meaning of the widely used term " Technology."

(A) Technology

The simplest meaning of technology is application of scientific knowledge for practical purposes in our day to day life.

Professor G.K. Galbraith in his book *New Industrial State* has mentioned these two characteristics of any technology:

1. Systematic application of scientific or other organized knowledge to practical tasks.
2. Forming the division and sub-division of any such task into its component parts.

If any body of knowledge in education or pedagogy can meet the demands of these two criteria, we shall unhesitatingly call it "*Educational Technology*".

(B) Educational Technology

(i) Definition

We have before us six definitions of Educational Technology attempted by authorities in this field or growing branch of knowledge:

1. According to G.O.M. Leith :
   "Educational Technology is the application of scientific knowledge about learning, and the conditions of learning, to improve the effectiveness and efficiency of teaching and training."

2. According to B.C. Mathis *et al* (authors of *Psychological Foundations of Education: Learning and Teaching*, (1970):

   " *Educational Technology refers to the development of a set of systematic methods, practical knowledge for designing, operating and testing schools as educational systems.*"

3. According to Takshi Sakamato (*Bulletin of the UNESCO Regional Office for Education in Asia*, September 1971).

   " *Educational Technology is an applied or practical study which aims at maximising educational effect by "Controlling" such relevant facts as educational purposes, educational content, teaching materials, educational methods, educational environment, conduct of students, behaviour of instructors and interrelations between students and instructors.*"

4. According to W. Kenneth Richmond (*The Concept of Educational Technology*, 1970):

   "*Education technology is concerned to provide appropriately designed learning situations which, holding in view the objectives of the teaching or training, bring to bear the best means of instructions.*"

5. According to S.S. Kulkarni (A pioneer of Educational Technology in India, 1966):

   "*Educational Technology may be defined as the application of the laws as well as recent discoveries of science and technology of sciences of the process of education.*"

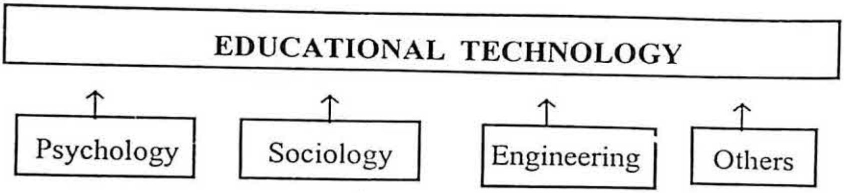
6. According to Robert A Cox (Article: "*The Process of Educational Technology: A Tool for Development*", 1970).

   "*The application of scientific process to man's learning conditions is what has come recently to be called "educational" or "instructional" technology.*"

(ii) Implications of Educational Technology

All these definitions help us in identifying the implications of Educational Technology, which may be put as under:

1. It is an applied or applicational body of knowledge.
2. It seeks to take help of the laws and findings of Psychology, Sociology, Engineering and some other basic social and physical sciences.



Foundations of Educational Technology

3. Its purpose or aim is "to improve the effectiveness and efficiency of teaching and training". Leith has mentioned in his definition — "to improve the process of human learning," as the definition of Educational Technology given in 1976 by the National Council for Educational Technology, U.K. also emphasizes.

4. It is wrong to confuse it with audio-visual teaching aids like teaching machines, TV., tape-recorder, radio, video-tape etc., or with Programmed Instruction materials.

   Actually, Educational Technology is a much wider concept or body of knowledge, and audio-visual aids and Programmed Instruction - its techniques and materials, are just some of the parts of it.

This confusion will be shed aside as soon as we pay attention to the scope of Educational Technology as outlined by its different leading specialists.

(iii) Scope of Educational Technology

According to most writers like J.D. Finn, Lumsdeine (1964), B. Claude Mathis *et al*, and DeCecco, there are two meanings or divisions of the scope of Educational Technology:

(1) Hardware Educational Technology

It is that part of Educational Technology which refers to tools and hardwares such as teaching machines, TV. tape recorders etc. which are used in instruction. This is much less emphasized part of Educational Technology today.

(2) Educational Engineering

Under this part is included a detailed analysis of learning and teaching phenomena. Due help of modern psychology, sociology, systems approach, (especially Psychology), and other basic foundational disciplines is taken in this task of systematic analysis. These basic sciences "refer to education in the same way as physics or mathematics might relate to mechanical engineering."

This is, actually, the most widely recognized meaning of Educational Technology today - much more than the hardware type of Educational Technology or than the softwares such as Programmed Texts.

In a interesting article "The Development of Educational Technology in Japan" (*Bulletin of the UNESCO Regional Office for Education in Asia*, Vol. VI, No. 1, September 1971), Takashi Sakamoto has found it convenient to divide the whole scope or field of Educational Technology into three areas as shown on the next page.

Areas of Educational Technology		*Contents*
I (a) Educational Technology		Application of audio-visual presentation equipments.
I (b) Educational Technology	(i)	Study and educational application of educational system situation.
	(ii)	Educational information retrieval.
	(iii)	Educational data processing.
II Educational Technology	(i)	Programme of Learning.
	(ii)	The optimal organisation of instructional activities.
	(iii)	Appropriate organisation of groups.
III Educational Technology	(i)	Design for teaching tools, e.g. desks, chairs, black-boards etc.
	(ii)	Planning of facilities such as school buildings and classrooms, etc.

3. A very simple diagram to illustrate the scope of Educational Technology may by drawn as under.

Inputs	SYSTEM:	Outputs
Students' *Entering Behaviour* or Objectives	*Purposes* *Content* *Processes*—Teaching —Learning —Interaction	Students with the expected Learning or *Terminal behaviour*

Instruction (Inputs)

4. S. S. Kulkarni suggests the following sequence of steps or paradigm of steps in Educational Technology:

Step I	To make a functional analysis of the teaching learning process. Location of various components operating from Input stage to Output stage.
Step II	To investigate the various functions these components perform, or possibly can perform.
Step III	(i) To see the effect of manipulation of the various components and their functions in the field. (ii) To see what combination of these components produce the optimum results.

5. Technology can be applied in these three areas of education—(a) General administration, (b) Testing, and (c) Instruction.

(iv) Significance of Educational Technology

Educational Technology is of great importance to all countries because of the possibilities of its three main contributions:

(a) Increasing the effectiveness of teaching-learning process

It seeks to increase or improve the effectiveness of teaching and learning processes. The students have then better development of their cognitive, effective and psychomotor domains of learning.

(b) Maximizing the Output:

It enables or facilitates more learning to take place in less time by applying various empirically established generalizations from the fields of psychology, sociology, and other social and physical sciences and engineering.

(c) Enabling the Optimum use of Resources

All countries, and especially the developing countries like India, have very limited resources in the forms of experts, sophisticated machinery or tools, school buildings, paper, time, etc. Educational Technology builds on this very premise and tries its level best to devise new ways and means whereby the teeming millions of a nation's children or/learners may derive optimum benefit from the limited resources which the nation can mobilise for educational purposes.

Section III: Educational Technology and Instructional Technology

Instructional Technology is not something totally different from, independent of, or against Educational Technology. According to Robert A. Cox, actually it is a "subordinate term" of Educational Technology.

Whereas '*Educational Technology*' is a wider concept having a wider perspective, the '*Instructional Technology*' is a narrower or parochial concept having a very limited perspective, approach or purpose.

Both *Educational Technology* and *Instructional Technology* have six common features as under:

1. Both have *certain goals* or *objectives.*
2. Both emphasize *analysis of the characteristics of learners.*
3. Both deal with *subject matter* or *curriculum.*
4. Both emphasize on the *mediating of the educational content and resources for presentation to and utilization by the learner.*
5. In both, *learner's performance is measured or evaluated.*
6. In both, *feedback is an important activity* in order to increase the effectiveness or efficiency of the inputs and processes and to revise the goals, if need be.

In spite of there superficial or outwardly similarities, both these differ considerably as would be clear from the following table:

Education Technology	Instructional Technology
1	2
1. A *wider* concept.	1. A *narrow* concept.
2. Priority of *goals decided in view of the context and needs of the nation* or geographical area concerned.	2. Priority of goals decided in view of the context and needs of the locality and the needs of the specified learners of a class
3. *Behavioural outcomes decided in view of the ultimate needs of the nation or region.*	3. Behavioural outcomes decided in view of the specific expectations from the learners when the given lesson is over.
4. *Attempt made to discover the skills and competencies of learner in specific age ranges all over the nation.*	4. Attempt made to discover the skills and cometencies of learners in a specific and limited geographical area, locality or one school.
5. Comparative *analysis* of *relationship of similar courses* for deciding the revision needs.	5. Analysis of the content of a particular subject for selecting and organising the items of knowledge to be put in a particular lesson.
6. Selection of educational media which would be helpful in organizing teaching-learning effectively and efficiently in many schools in the region.	6. Selection of Educational media which would be helpful in organizing teaching learning effectively and efficiently *in the given class or school in the locality.*

1	2
7. Deciding to produce books, films, P.I. materials *on a large scale.*	7. Teachers and pupils interested in preparing only a few things *for their own classroom consumption* from locally available materials or resources.
8. Emphasis on the measurement and evaluation of the learners' academic performance at the national or regional level.	8. Emphasis on the measurement and evaluation of the learners, academic performance in the given class in terms of its specifically and rigidly laid down terminal behaviour at the end of the lesson.
9. Feedback emphasized for a comprehensive improvement in the teaching learning phenomena at the macro level.	9. Feedback emphasized for a comprehensive improvement in the teaching-learning phenomena at the micro level.

Section IV : Epilogue

We have seen that Educational Technology is not just using audio-visual aids and teaching machines in teaching or using programmed lessons as most people say in confusion and error.

It is, in fact, a growing, dynamic and vitally significant engineering in the field of pedagogy, as it seeks to analyse, reform, remodel and even build anew the various paradigms of learning and teaching processes in vogue in schools and colleges throughout the world by judiciously applying the established laws, principles, concepts, theories and empirically derived findings of modern psychology, sociology, engineering, administrative theory, mathematics and other basic disciplines.

Its purpose is to systematize and modernize teaching and learning strategies so that improvement, efficiency and economy in them are achieved as warranted by the demands of the new age of rapidly advancing technology and socialization for the unknown future. As J.D. Finn has rightly remarked, the contributions of Educational Technology would indeed be of great significance for it seeks: (a) to ensure adequate supply of scientists and technicians in education, (b) to raise the level of general education of all citizens, and (c) to extend and improve the instructional process itself.

Questions

1. Discuss the concept of Educational Technology. In what respect does it differ from the concept of Instructional Technology?

2. Discuss the implications of an Educational Technology for a developing country like India.

3. "Educational Technology is the application of scientific knowledge about learning, and the conditions of learning, to improve the effectiveness and efficiency of teaching and training." (G.O.M. Leith). Elucidate the statement.

4. Differentiate between Behavioural (Instructional) Technology and Educational Technology.

CHAPTER II

OPERATION IN LEARNING

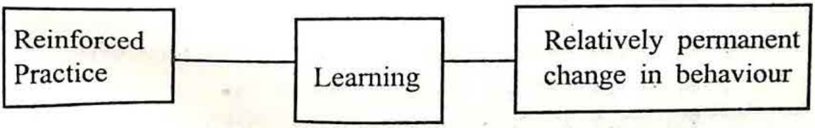
Section I: Introduction

Learning occupies a central place of importance in any educational system or phenomenon. A systematic and efficient educational system requires that learning should take place effectively. The researches and writings of psychologists over a period of about 100 years have revealed that learning is not a simple matter; it is a highly complex process involving some identifiable operations and characteristics.

In this chapter, we shall first define learning as modern psychologists have done, and then throw light on the operations in learning.

Section II: Learning Defined

1. According to John. P. Dececco, author of *The Psychology of Learning and Instruction: Educational Psychology,* (1968), who is in full agreement with Kimble and Garmezy, *"Learning is a relatively permanent change in a behavioural tendency and is the result of reinforced practice."*



The Concept of Learning

Like Gagne, Dececco is also of the view that a learning event has three constituents:

(a) learner
(b) stimulus
(c) response

2. B. Claude Mathis *et al*, authors of *Psychological Foundation of Education: Learning and Teaching* (1970), define learning as under:

> "When we speak of change in behaviour, we are often speaking of learning, one special kind of such change. *Learning is a relatively permanent change in behaviour resulting from experience."*

These authors are of the view that much of the learning consists of the acquisition of information, but some desirable behaviour like good citizenship or swimming cannot be learnt simply by teaching the facts pertaining to them.

We find much similarity in these two most recent definitions of learning. Both of them agree that learning means change in behaviour, it is of a relatively permanent nature, and it is caused by a certain experience, practice or reinforcement. It may be formal as well as informal, but the process of learning invariably entails all these requirements.

Section III : Operations in Learning

Learning involves three basic or essential operations:

1. Response by the learner
2. Sustenance of the response pattern
3. Feedback and motivation.

Operation I: Response by the Learner

There must be some evidence of learning in the form of response on the part of the learner. If learner has not responded, we cannot say that learning has taken place. In Programmed Instruction, the learner is invariably made to respond. In cognitive and affective areas also, certain indication, manifestation, participation style, or comments of learners must be forthcoming. It is a different matter as to what sort of response is it. It may be in form of just repetition of the learnt thing or piece of information, or a highly creative or new response, or an efficient skill performance. Whatever it may be, but it is indeed the most important operation in learning.

Operation II : Sustenance of the Response Pattern

The second important operation in learning is that of "Sustenance of the response pattern." If a learner is able to sustain when the stimulus is presented and he continues to learn and respond, we say that a response pattern has operated there.

As a result of teaching, a certain "repertoire" must be developed on the part of the learner. Repertoire means a set of responses or a pattern of responses. Take, for example, learning of a foreign language like German language. This will necessarily involve a pattern of responses of different types—responses relating to words, responses relating to structures, responses relating to the use of those structures in proper contexts, and the like. Thus, there are bound to be various types of repertoires—repertoires in terms of reading, writing, listening, verbal expression, numerical expression, etc. It can well be understood that repertoires for different languages are bound to be different for different people as there are always individual differences in people who are learners, and as each language requires some specific types of responses.

Unless responses given by a learner actually show some consistency, sustenance, repetition, flow or a patterning characteristic, it would be difficult to say that learning is taking place.

Operation III : Feedback and Motivation

The third important operation in any significant learning is that of feedback and motivation. A learner's repertoire will take a very long time to learn each and everything around him or presented to him in a certain teaching. Hence, there is a great need for him to be selective in his learning behaviour. It is the task of the teacher or instructor to divert, stimulate or motivate the interest and attention of the learner to certain selected units, aspects or things of the content, subject matter or the experiences to be learned by the learner.

That is why, we find all good teachers using a variety of reinforcers in their teaching. This helps students or learners under their charge to learn effectively in the educational group situation. They do many things or exhibit many sorts of behaviours or things in order to motivate their students to keep on learning. A very popular and significant device is to provide '*feedback*' to the learners. "Feedback" means knowledge of results. It is a common observation that every normal learner is very eager to know whether the response given or emitted by him has been treated by his teacher, elder or evaluator as correct or incorrect. If it is correct, the learner feels happy and he is motivated to learn and respond further. If it is incorrect, he is likely to be unhappy, sorry, frustrated and unmotivated to learn further. Case studies of backward learners or dullards show that proper and prompt feedback was not given to them by their parents, teachers and others who were trying to socialize, train or educate them.

In Programmed Learning, which is the latest and most favoured form of learning in Educational Technology today, the learner is given feedback regularly at each step. Ever since Thorndike and B.F. Skinner demonstrated the great importance of feedback or reinforcement, Educational Psychology has been immensely enriched by the research findings and writings of innumerable psychologists on this third vitally important operation in learning. In modern state of knowledge in the field of pedagogy, one cannot think of learning without feedback. Gone are the days when some inefficient, authoritarian and insensitive teachers used to teach children in total disregard to the happiness, motivation, feedback or reinforcement of the children.

Section IV: Concluding Remarks

We have seen that in order to cause a relatively permanent change in a behavioural tendency of a learner, at least three basic operations—(a) response by the learner, (b) sustenance of the response pattern, and (c) feedback and motivation are invariably involved.

Modern Educational Psychology and modern Educational Technology are seized of the concern as to how effectively and efficiently these three basic operations in learning may be made possible in different types of learning situations. Efforts are being made by psychologists and educationists to take note of the diverse psychological, scientific and technological factors influencing these learning operations. Teachers desirous of giving effective teaching must understand these learning operations and adjust their teaching accordingly.

Questions

1. What are the basic operations in learning? What is their significance for a teacher?
2. Define learning and discuss some of the essential operations involved therein.

CHAPTER III

TYPES OF LEARNING

Section I: What Learning Means

Floyd L. Ruch, author of *Psychology and Life* (1970), defines learning as *"a process which brings about changes in the individual's way of responding as a result of contact with aspects of the environment."* Behavioural changes induced by drugs, brain injury, or maturation are not recognized as learning by psychologists.

John P. Dececco (1968), and B. Claude Mathis *et al* (1970) in their respective definitions of learning emphasize two important features of learning:

(i) It is a relatively permanent change in the learner's behaviour.
(ii) It is the result of some reinforced practice or experience.

Despite the fact that innumerable psychologists have been most actively interested in their research pursuits in the area of learning during the last 90 or 100 years, we are surprised to come across a very criptic comment by a perceptive author Floyd. L. Ruch that "What actually takes place during learning is still a mystery......" It is a fact, assure many other recent psychologists, that with all the sophisticated theories and elements of learning that we boast of today, we still know only a fraction of the real nature and kinds of learning in human beings. It is this challenge or bug-bear which constantly keeps psychologists all over the world probing deeper and deeper into the hidden nooks and corners of the kingdom of human learning.

Section II: Kinds of Learning

Textbooks on Educational Psychology published till as late as 1955 in India and abroad, used to describe only four broad kinds or types of learning—(1) Imitation, (2) Trial and Learning, (3) Learning by insight, and (4) Conditioning.

Since then much research on the types of learning has been accomplished, so much so that when we come across author David p. Ausbel's *(Educational Psychology: A Cognitive View,* 1968) two-fold typology of learning —

(1) Reception *versus* Discovery Learning, and
(2) Meaningful *versus* Rote learning,

we are left unsatisfied with his treatment of learning.

Floyd L. Ruch in *Psychology and Life* (1970) mentions five kinds of learning :

(1) Conditioning
(2) Discrimination Learning
(3) Imprinting
(4) Motor skill learning
(5) Attitude learning.

This classification also appears to be unsophisticated and unimpressive when we are face to face with Robert M. Gagne's typology of learning in his renowned book '*The Conditions of Learning*' (1970).

Gagne's Typology of Learning

1. Signal learning
2. Stimulus-response learning
3. Chaining
4. Verbal Association

5. Discrimination learning
6. Concept learning
7. Rule learning
8. Problem-solving

Let us briefly describe these kinds of learning:

Type I: Signal Learning

Learning to respond to a signal is called '*Signal Learning*' Likes and dislikes can be acquired through such learning. "The sight of mother's face may become a learned signal to the infant for various pleasurable events associated with the presence of the mother." As soon as we see the real face or just a picture, or hear the name of our old middle school in which we were taught, or think of a particular school teacher who taught us in our childhood, either a happy or pleasant memory or a feeling of regret or nostalgia is evoked in us as a result of signal learning. The author of '*Dark Places in Education*' very pathetically described the sad memories of a number of great persons about the cruel and inhuman schools they attended in their childhood, which they narrated to the author when the latter asked them about their school memories.

Gagne is right when he remarks that "signal learning may be of positive usefulness in establishing the common "signals" to be used by the teacher in setting stage for attention, rest periods or other regularly occurring event."

One important characteristics of this type of signal learning (that is, the Pavlovian Conditioned response) is that the responses are general, diffuse, emotional one. Precise voluntary responses such as driving one's particular screw in a machine can not be acquired by this kind of learning.

Type II: Stimulus-Response Learning

In such a learning, the learner has to give a precise response

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to a discriminated stimulus. What is learnt is called a "connection" in Thorndike's terminology, a "discriminated operant" in Skinnerian terminology, or an "instrumental learning" in Kimble's terminology.

Gagne gives the example of a dog learning to shake hands in response to a vocal stimulus provided by his master or by another friendly person.

The characteristics of this kind of learning are:

(a) The response are generally very *precise* or specific.
(b) This learning takes place *gradually,* not immediately.
(c) This *response of the learner becomes more and more sure and precise* throughout several occasions.
(d) The *controlling stimulus also becomes more and more precise.*
(e) The "reward" or *"reinforcement"* is given for the correct responses emitted or shown by the learner.

In Programmed learning, this type of learning is the backbone of teaching-learning process. This kind of learning can be sketched as under :

$$S_s \longrightarrow R$$

Where the S is an external signal;

s is the accompanying internal stimulation.

R is the response.

Other potential $S_s \longrightarrow R$'s are disestablished (or "extinguished") by the events of learning. Skinner calls this capability as a "discriminated Operant." Its example is a rat learning to press a level in the presence of light (the external S), and at the same time distinguishing this response when the external S is darkness.

This type of learning takes place when a young child tries to acquire a new vocationalised habit, or when an adult is taught how to pronounce an unfamiliar foreign language words correctly.

Type III: Chaining

Connecting together in a sequence two or more previously learned $S_s \longrightarrow$ R's is called "Chaining" type of learning. In learning a language, the students have to learn many such chains of verbal sequences, word associations, e.g. "boy meets girl", "over and above", "part and parcel."

This type of learning takes place when a parent tries to teach a young child to learn the name of a doll. Some of the most important stages or chains of behaviour occurring in this case would be under:

(1) $\underset{\text{doll}}{S_s} \text{ ——————— } \underset{\text{doll}}{R}$

(2) $\underset{\text{lying down}}{S_s} \text{ ——————— } \underset{\text{hugging doll}}{R}$

(3) $\underset{\text{lying down}}{S_s} \text{ ——————— } \underset{\text{hugging doll}}{R} \text{ ————— } \underset{\text{doll}}{S_s} \text{ ————— } \underset{\text{doll}}{R}$

The following *conditions* must be fulfilled for this sort of learning to occur :

(1) The *individual links in the chain must have been previously established.*

(2) There must be *contiguity* of each link with the next one.

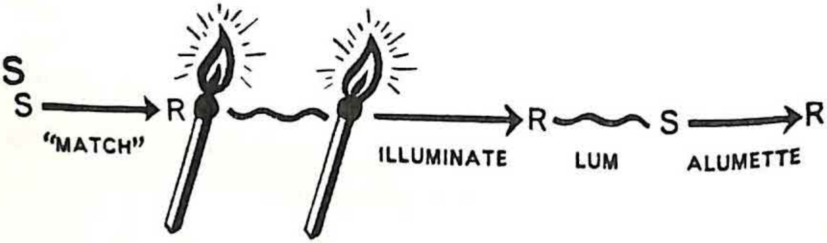
(3) When the above two conditions are fully met, it is observed that chaining occurs. Gilbert's "Mathetics" is solely based on the "chaining" type of learning. It is indeed a very complex thing.

Type IV : Verbal Association

Verbal Association is the learning of chains that are verbal.

One learns to translate an English word into a foreign one by acquiring a chain. Gagne gives this example: The following sets of events can occur in order to learn that the French word for "match" is *alumette.*

1. The learner examines the combination "match—*alumette*" and notices that something already known connects the two: the syllable "lum" which occurs in the word "illuminate."
2. He then says "a match illuminates; lum; *alumette.*
3. For some learners, this is most readily established by means of image of a match bursting into flame, which means that the entire chain would be as under:



"Coding connections" and "Contiguity" are very necessary conditions for such a learning.

Type V: Discrimination Learning

When an individual learns to make a number of different identifying responses to as many different stimuli which may resemble each other in physical appearance to a greater or lesser degree, that is called "discrimination learning."

In the simplest form it involves differentiating timulus-response connections. Examples of discrimination type of learning are :

(i) Teacher trying to call each of his students by their correct names.

(ii) A student trying to distinguish plants, animals, chemical elements, rocks, rivers, colours, statistical symbols, letters, numerical and operation symbols etc.

This type of learning does emphasize "rote learning" in most cases, but this is not the case in all cases. Discrimination is a kind of covert response.

Discriminate learning is very important because in all types of formal education this is very much prevalent.

Type VI : Concept Learning

A learner's acquiring the capability to make a common response to an entire class of stimuli-objects or events that may be different from each other in physical appearance is called Concept learning.

Learning a concept means learning to classify stimulus situations in terms of abstracted properties like colour, shape, position, number, weight, importance, etc. For example, in order to teach the child the concepts of "middle", "larger than this one", under and above," "right and left," "outside and inside," "tradition" and "modernity", etc., the teacher may use examples of objects and situations diverse in nature, shape, colour, size, etc. Gagne illustrates this by giving the example of learning the concept of "middle" as under :

1. ● ● ●
(Middle one)
2. ▲ ▲ ▲
(Middle one)
3. ❒ ● ❒
(Middle one)
4. ▲ ● ❒
(Middle one)
5. ● ❒ ▲
(Middle one)

Thus the conditions for concept learning are :

(1) This stimulus portion of the chain (by means of which a middle block is differentiated from the two others in the set) must have been previously learned.
(2) A *variety of stimuli* must be presented incorporating the conceptual property to be learned.
(3) The learning of a brand new concept can in some cases be a gradual process.
(4) Level of abstraction is a must. The learner must be able to extract the abstract from the various stimuli. In other words, he should be able to squeeze the properties of a class of stimuli.
(5) Concept building is quicker when more and more challenging things or examples are presented to the learner.

Type VII : Rule Learning

A rule is a chain of two or more concepts. The simplest type of rule is generally as under :

"If A, then B."

Examples

(1) "Gases expand when heated."
(2) na + nb = n (a + b)
(3) Article "an" is used before every hour of singular number starting with a vowel letter."

Human beings learn innumerable rules from simple to complex in their life as they develop in their formal education and experience in life.

Although any learner can be made to cram up any rule by training, yet learning how to apply a rule intelligently in different new situations and to know how a particular rule has been evolved or derived is indeed a different kind of learning—an elevated or higher kind of learning. Reflective level learning generally consists of such a kind of rule learning. The criterion of rule learning is whether the learner is able to use the rule in different unknown situations.

Conditions : Rule learning goes on effectively in the following conditions :

1. The concepts to be linked must have been previously established. In other words, when the learner has known how to classify the concepts being chained, then only can a rule be learnt.
2. The concepts must then be chained.
3. The learning of a rule or idea takes place in a single occasion.
4. The idea is established in the mind of the learner by more and more examples.

Type VIII : Problem-solving

According to Gagne, "Problem-solving is a kind of learning that requires the internal events usually called thinking. Two or more previously acquired rules are some-how combined to produce a new capacity that can be shown to depend on a "higher order" rule. Capacity for further thinking must be increased by problem-solving type of learning.

Examples

(1) When a car driver maps his route through traffic he is solving a problem.

(2) When a house-wife decides to purchase household articles selectively keeping in view the prices of different articles, she is solving a problem.

(3) Any great scientific discovery or invention or a great work of art is the result of problem-solving activity.

In all disciplines learners are confronted with numerous problems which stimulate them to think and *solve the problems by combining their previously learnt rules or generalizations with their new ideas springing up just then and there.*

Conditions

1. The learner must clearly know the essential features of the whole paradigm or series of steps to solve the problem.
2. He must recall the relevant rules which he has learnt in the past.
3. The recalled rules are combined or reorganized and this leads to the emergence of a new thinking—a new rule that is learned as it is solves the problem.
4. The entire solving of a given problem involves many individual steps or stages, and so it takes sometime.
5. The learner should be directed by the teacher how to proceed in a given direction step by step so that he is able to solve the given problem.
6. Many problems are indeed solved by a "flash of insight."

Problem-solving type of learning is indeed a very superior kind of learning and so good teachers see that this is facilitated by their classroom teaching. They use many strategies of teaching for this purpose.

Conclusion

Thus we have seen that there is not one kind of learning — there are infact many kinds of learning. One cannot become an effective teacher if he knows only a few strategies for facilitating only one or two kinds of learning on the part of his or her students. A teacher must understand the conditions, requirements and applicability of each of these kinds of learning and try to make real provisions for each of them in his teaching in suitable learning situations. It is erronous to say today that all learning is basically the same when each type of learning described above begins with a "different state of organism" and ends with a "different capability for performance."

Questions

1. "All learning is basically the same." How far do you accept this view?

2. What are the different forms (kinds or types) of learning in human beings? What are their implications for school teachers?

3. "The most important class of conditions that distinguishes one form of learning from another is the initial stage of learning—in other words, its pre-requisites." (*Gagne*) — Mention the pre-requisites of signal learning, Discrimination learning, Concept Learning and Problem-solving.

CHAPTER IV

PHASES, OPERATIONS OR TASKS IN TEACHING

Section 1: Prologue

In this chapter, we are concerned with the identification of the various operations or tasks involved in the process of teaching. But before doing that, we consider it necessary to start with a very brief mention of the concept of teaching and the phases of teaching, as they will facilitate the exposition of the operations in teaching.

Section II: The Concept of "Teaching"

Although teaching is one of the oldest activities in the history of human civilization and a major share of credit for human progress so far indeed goes to this activity, yet it is a queer paradox that such a significant activity has not been very intensively analyzed by researchers as yet. The result is that what we know about the reality of teaching even today is only a small fraction of it.

Teaching Defined

We have before us four definitions of teaching given by leading experts in the educational world :

1. *"Teaching: arrangement and manipulation of a situation in which there are gaps or obstructions which an individual will seek to overcome and from which he will learn in the course of doing so."*

(Adapted from John Brubacher, *Modern Philosophies of Education,* 1939).

2. *"Teaching : intimate contact between a more mature personality and a less mature which is designed to further the education of the latter."*
   Henry C. Morrison *Basic Principles of Education,* 1934).
3. *"Teaching is a system of actions intended to induce learning."* (B.O. Smith, 1961).
4. *"Teaching is a form of interpersonal influence aimed at changing the behaviour potential of another person."*

(American Educational Research Association (AERA) Committee on the "Hand-Book of Research on Teaching," 1962).

Without going in for any exposition or criticism of these renowned definitions of teaching, we would only like to say that teaching, as suggested by these definitions, is not a simple affair—it is not just all that what a teacher does between the timings of his entry in and exit from a classroom. It is a highly complex socio-psychological activity or process which has a great bearing on learning on the part of the learner, as well as on the part of the teacher himself. This process invariably implies four things: Teacher, Teaching, Learning and Learner. A very functional sort of definition has been given by Professor K.P. Pandey," *"Teaching is an influence-directed activity....; it is influencing the learner with a specific content structure."*

Section III: The Phases of Teaching

The activity or process of teaching in now systematically analyzed in terms of three stages or phases :

Phase I : Pre-active Phase of Teaching
Phase II : Inter-active Phase of Teaching
Phase III : Post-active Phase of Teaching

The *Pre-active Phase* of teaching is infact the stage of planning for teaching. All that a teacher does before he actually enters a classroom to teach is covered within this phase.

The *Interactive Stage* of teaching includes all those behaviours,. activities or things done between the time of the teacher's entry in the classroom and the time when the lesson or subject-content has been delivered by him.

The *Post-active Stage* of teaching is nothing but the evaluative phase. This is the phase which deals with all that takes place after the teacher has left the classroom. How do the students and the teacher evaluate or react to the teaching-learning activity done in the classroom and what changes do they start thinking of introducing for a better activity next time? Such questions are posed in this third phase of teaching.

Let us know go deeper and try to identify the minor operations involved in each of these three stages or phases of the teaching process.

Section IV: The Operations of Teaching

(A) OPERATIONS IN THE PRE-ACTIVE STAGE OF TEACHING

At the "Pre-active Stage" of teaching, the following minor operations or sub-stages are almost always there :

1. Fixation of goals
2. Decision-making about the subject-matter
3. Arrangement/sequencing of ideals and style of presentation
4. Deciding about the use of strategies of teaching
5. Deployment (or distribution) of teaching strategies.

Let us briefly explain these operations. According to P.W. Jackson, (1966), who has originally contributed the distinction between the "Pre-active" and the "Inter-active" phases of teaching, in the Pre-active phase, the teacher "selects objectives, plans the curricula, arranges the classroom, and studies the readiness of the pupils."

1. Fixation of Goals

The teachers decides in details as to what should be the specific instructional objectives in the form of clearly defined terminal behaviour on the part of learners (students) at the end of the teaching proposed to be done by him in a particular class period or time. He decides as to at what level of sophistication or abstraction he is going to fix up the goals. Also he takes into consideration the characteristics and needs of the society and the school.

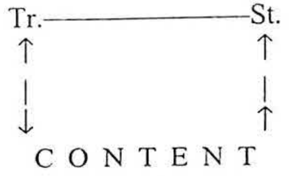
2. Decision-making about the Subject Content

He then decides about the amount of content of knowledge to be imparted to the students and the specific structures he will try to develop in this class. Such a decision he takes keeping into consideration three things :

(a) Demands of the curriculum given to him (or developed by him).
(b) The entering behaviour and the learning needs of the learners.
(c) The motivations of the learners.
(d) His own preferences for and judicious assessment of things relating to the topic at hand.

3. Arrangement of the Ideals and Styles of Teaching

He then tries to decide as to what shall be his style or styles at different stages of the development of his lesson teaching.



Operations at the Preactive Stage

4. Decision-making about these Strategies of Teaching

He then decides about the strategies (i.e. methods as well as techniques) he will employ in his teaching. There are many kinds of methods of teaching readily available to him as he has already been trained in them in his Teacher Training Course. The techniques can be of two types—*verbal techniques* and *non-verbal techniques*. These techniques are related to class handling and to verbal learning that has to take place in the classroom.

5. Deployment of Teaching Strategies

He has to decide in advance as what strategies will be used by him and when and how in course of his classroom teaching. When shall he go in for questioning, when for blackboard sketching, when for showing pictures, when for lecturing, when for recapituation, etc. These questions must be clearly answered by him if he wants the pre-active stage of his teaching to be over successfully.

(B) OPERATIONS IN THE INTERACTIVE STAGE OF TEACHING

According to P.W. Jackson (1966), in the interactive phase, "the teacher provides pupils verbal stimulation of various kinds, makes explanations, asks questions, listens to student's responses and provides guidance."[1]

The operations involved in this phase may be identified as under :

1. Sizing up of the Class
2. Diagnosis of the learners
3. Action or achievement or Reaction
    (a) Selection of Stimuli
    (b) Presentation of Stimuli
    (c) Choice of Strategies
    (d) Deployment of Strategies

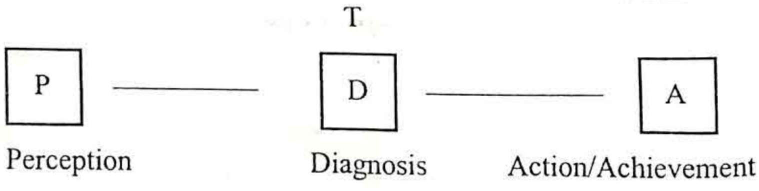
Now let us describe these minor operations.

1. Sizing up of the Class

As soon as the teacher enters the class he applies his perceptual apparatus. He rolls his eyes around the faces of the learners, locates which area is or may be troublesome area, which faces are or may be discouraging, encouraging or apathetic to him. Thus he tries to size up the class group before him. Similarly, the students also size up the whole personality of the teacher within a few initial seconds.

2. Diagnosis of the Learner

He then tries immediately to diagnose the levels of achievements of his students in three areas—(a) abilities, (b) interests and attitudes, and (c) academic backgrounds.



The Teaching Process/Chains

3. Action or Achievement

(a) Selection or Stimuli

The stimuli in the action or activity of teaching can be *verbal* as well as *non-verbal* (like gestures, expressions, features like democraticization, the way the teacher stands and moves around etc.

A good teacher must know as to which ones would be the relevant stimuli and which ones would be the irrelevant stimuli in that particular teaching situation. He should be able to decide and select the relevant, desirable or functional stimuli at once then and three in view of the practical situation present before him. A kindergarten school teacher knows what stimuli may be fruitfully applied to her class, but the college lecturers or P.G.T.s (Post-Graduate Teachers) may fail to decide about them correctly or effectively.

(b) Presentation of the Stimuli

The teacher must then perform the task presenting the stimuli and for this he must carefully consider three things :

(i) *Form:* In what forms should the stimuli be presented?
(ii) *Context*: In what context or setting should the stimuli be presented?
(iii) *Order:* In what order or sequence should the stimuli or new knowledge and expression be presented to the learners.

(c) Feedback or Reinforcement

Feedback or reinforcement is a condition which will increase the probability that a particular response will be accepted in future.

The feedback or reinforcement may be of two types:

(i) *Positive reinforcers:* which may increase the probability of the recurring of the correct or desired behaviour, e.g. praise, appreciation, reward, giving medal, testimonial, sweets, flattery, etc.

(ii) *Negative reinforcers:* which are efforts to do (or get done) something in order to avoid something. For example, a boys goes to the reading table in order to avoid the frown of his mother or beating by his father.

The reinforcement may be applied for three purposes :

(i) For strengthening the response;
(ii) For changing/partially changing the response;
(iii) For modifying or correcting the response/behaviour, e.g. punishment.

(d) Deployment of Strategies

The strategies of reinforcing the students, of controlling their the verbal and non-verbal, and of imparting subject content systematically and effectively to the learner continues for must of the time while a teacher is teaching.

Let us not forget that these operations are performed simultaneously by the students also in the class. They also size up the teacher, diagnose his personality as teacher, and select and provide stimuli, feedback and deploy various strategies to influence his teaching and to be influenced by his teaching.

Operations at the Interactive Stage

T Teacher	*S Student*
(P)——(D)——(A) Perceptual Diagnostic Achievement	(P)——(D)——(A) Perceptual Diagnostic Achievement

Thus we have seen that in the interactive phase, the interaction in teaching falls in three areas or contexts :

(i) *Subject-matter*
(ii) *Learning*—kind or levels of learning (cognitive, affective and skill levels)
(iii) *Context of the learners*—their backgrounds, needs motivations, attitudes, cooperation or opposition, etc.

Sociological Contributions to the Understanding of the Interactive Phase of Teaching

The Interactive phase of teaching is essentially a psycho-sociological phase, and so it has attracted the attention of many able sociologists and psychologists. Innumerable sociological, psychological, cultural and economic variables interact very complexly in this phase and hence its thorough study is indeed very difficult. The interaction of these diverse variables create certain types of climates in the classroom which affect teaching and learning in the classroom.

Some of the highlights of very important sociological research studies or writings on the sociology of classroom teaching are as under :

1. *John Withal* (1951)
   Two kinds of classroom climates:
   (a) Learner centred climate
   (b) Teacher centred climate.

2. *Harold H. Anderson* (1946)
   Two types of teachers' classroom personalities:
   (a) Dominative behaviour/personality.
   (b) Socially integrative personality.
   (or democratic personality.)

We may add also (c) *Charismatic personality* (teacher having some charisma, spell or charm in his personality).

3. Ruth Cunningham *et al (Understanding Group Behaviour of Boys and Girls,* 1951)

Five patterns of teacher-student interaction :

(a) *Adult rule, child obedience.*
(b) *Planless Catch-as-catch can:* (The teacher does not try to control the group of students before him.)
(c) *Teacher planning with individuals:* The teacher gives individual attention to his students but he curtails their group interaction.
(d) *Adult-directed group learning*
(e) *Group Self-management:* The group of students is capable and mature enough to direct its own activities).

4. *Getzels and Guba,* 1957.

Two types of human activities (applicable to teaching activity also) :

(a) *Nomothetic activity* which seeks the fulfilment of the goals determined by the social system.
(b) *Ideographic activity* which seeks the fulfilment of the goals concerned with the meeting of the personality needs of the members of the social system, i.e., students in case of teaching.

5. *Heil, Powell and Fiefer,* (1960)

Three major types of teachers :

(a) The *"turbulent" teachers*: who are intellectuals, freedom-loving, bold, imaginative, creative, short-tempered.
(b) The *"Self-Controlling" teachers:* who are quite disciplined and efficient.
(c) The *"fearful" teachers:* who are uncertain, confused,

fearful, ridden with inferiority complex, weak-hearted and unassertive.

Four types of students

(a) The *"Conformers"*
(b) The *"Opposers"*
(d) The "*Wavers*"
(d) The *"Strivers"*

6. *Talcott Parsons: Analysis of Elementary School Class:*

(1) The Problem: Purpose: *Socialization* and *Selection*
(2) Description of the *Social Structure of the Elementary School Class.*
(3) *The Nature of School Achievement.*
(4) *Family and Peer Group in Relation to the School.*
(5) *Socialization and Selection in the Elementary School.*
(6) *Differentiation and Selection in the Elementary School.*

7. *Willard Waller (The Sociology of Teaching,* 1965): *Key ideas:*

(1) "The teacher-pupil relationship is a form of institutionalized dominance and subordination."
(2) "The teacher represents the established order, as such he must be ready to enforce conformity and to enforce discipline."
(3) "The teacher following his customary role, attempts to delimit the social interaction of the classroom. He strives to channalize the attention of the students and to make it work upon subject-matter."
(4) Nearly all the classic concepts apply to life in the classroom—war, feud, litigation, conflict of ideals, victory, alienation, compromise, conversation, accommodation and assimitation."

8. Karl Mannhaim

Two types of controls in school:

(*a*) *Manifest Control:* represented by active learning.
(*b*) *Latent Control:* represented by passive learning, attitudes, habits, etc. developed indirectly.

(C) OPERATIONS IN THE POST ACTIVE PHASE OF TEACHING

These are as under :

1. *Defining the exact dimensions of the teaching changes.*
2. *Selecting appropriate testing devices and techniques.*
3. *Changing the strategies in terms of evidences gathered.*

Let us briefly describe each of these important operations:

1. Defining the Exact Dimensions of Behavioural Changes

The teacher compares the expected and the actual behavioural changes in course of his teaching at the end of teaching. Most pupils also do similar activity at the end.

2. Selecting Appropriate Testing Devices and Testing

The teacher chooses certain suitable testing techniques, and tools to measure the various dimensions of behaviour and thus note the changes brought about by his teaching. The tests may be of many types e.g., paper-pencil test, standardized text, objective type tests, informal or teacher-made tests, etc.

3. Changing the Strategies of Teaching

The results of the testing as above enable the teacher to understand where he lagged behind in his teaching goals, standards, aspects and why, and how he can improve his teaching by restructuring the teaching situation.

Section V: EPILOGUE

Thus we can conclusively say that although in teaching we deal with children, yet teaching is not a child's play. It is a highly complex activity or process and it determines the extent of quality and quantity of learning that would be possible in the classroom. Hence a teacher, who aspires to be a good teacher, that is one who wishes to adopt the principles of modern Technology of Education in his teaching, must carefully analyse his teaching behaviour at all the three phases or stages of teaching and must try to proceed according to the operations identified in the preceding description, in an intelligent, enlightened, dynamic and creative manner.

Questions

1. What are the major teaching operations which a teacher has to engage in?
2. "A revolution in teaching is being fomented." (Gage and Unruh). Elucidate the statement in the light of the operations in learning.
3. "Teaching may best be defined as the organization of learning. So the problem of successful teaching is to organize learning for authentic results." (J.L. Murshell). Comment on the statement.
4. "To date, attempts to describe the teaching process have concentrated on what goes on during teaching sessions when teachers and students are face to face....Much that the teacher does before and after class, as an instance, must be considered if we are to obtain a complete description of his professional activity." (Philip W.J. Jackson). Discuss the statement.
5. How can you assess (or analyse) teaching? Give examples to illustrate your answer.
6. Describe the various teaching tasks involved in the interactive phase of teaching in a school class.

7. Describe the interactive process of teaching tasks with illustrations from classroom situation. What are the various dimensions of interaction which you can analyse as a teacher?
8. Suggest suitable paradigm for the analysis of teaching act. What empirical proof will you need for this?
9. What do you think is the ideal behaviour of the teacher in the classroom for effective learning? Give examples from your experience as teacher.

References

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CHAPTER V

THEORIES OF TEACHING: A REVIEW

Section I: Introductory Comments

Professor B. Othanel Smith of the University of Illinois, who a very leading technologist of education, has defined teaching as *"a system of actions intended to induce learning,"* (1961).

There are many other definitions of teaching available, but this one seems to be the most suitable in view of the recent theoretical advances in the emerging field of Educational Technology.

It is interesting to note that although theory-building in the area of "learning" has been a very popular and old activity, yet such an activity in the area of "teaching" has hitherto been neglected. N.L. Gage advances two main reasons for this neglect :

(a) The controversy whether teaching is an art or a science, has so far not been resolved. While Gilbert Highet insists on treating teaching as an art (*The Art of Teaching*, 1955), a host of writers treat it as a science.

(b) The theories of learning are also inadequate, since they deal with the behaviours of the learners, and not equally with those of the teachers, whereas the fact is that changes in education must depend in large part upon what the teacher does.

Of late, considerable interest in theoretical analysis of teaching has been shown by educational technologists, psychologists, sociologists of education and philosophers, and a number of theories of teaching or theoretical concepts, constructs or models of teaching have appeared on the scene. All such theories of teaching have been briefly given in the most valuable collection '*Contemporary Thought on Teaching*' edited by Ronald T. Hyman, (1971). The names of scholar like Socrates, William H.Kilpatrick, Kenneth, B. Henderson, Elizabeth S. Maccia Jerome S. Bruner, Ben Strassers, Israel Sheffer, John Walter and John R. Scudder, Jr., etc. have been associated with the various theories of teaching which have come up in recent years.

Section II: A Broad Classification of the Theories of Teaching

All the available theories or models of teaching may conveniently by classified into just two broad categories:

1. *Normative Theory of Teaching or T.L. (Teaching Learning) Theory.*
2. *Positivistic Theory of Teaching or T.A. (Teaching Act) Theory.*

Let us briefly describe these theories in the next two sections.

Section III: The Normative Theory of Teaching

A very old and widely popular view or theory in the field of education has been that teaching and learning go together. Notable philosophers of education like William H. Kilpatrik (*Foundations of Method*, 1930) and John Dewey (*How we Think*, 1934) held this view. Kilpatrik has categorically said, *"Unless the child learns the teacher has not taught."* Kilpatrik compared teaching as "selling". According to him, we can race, hunt or sing without the assistance of others, but we can carry on business or the activity of selling only if there is someone else as a customer or client to whom we can sell. Similarly, we can teach only if there is somebody whom we can teach.

Thus, according to this view, teaching involves teacher, teaching, learner and learning:

Selling	*Teaching*
1. Seller	1. Teacher
2. Selling	2. Teaching/Instruction
3. Buyer	3. Student
4. Buying	4. Learning

T.L. Theory

According to this theory, the teacher teaches the learners keeping in view certain goals, norms, ideals or traditions of his society in order to bring about certain expected outcomes in his behaviour.

Hence, this theory emphasizes two basic things :

(i) *That teaching and learning are closely interrelated* as cause and effect, or as two sides of coin.
(ii) *The teaching is done always according to certain norms of society* and the teacher's talk in fact is to socialize the child.

The following four well-known philosophical models or theories of teaching have generally taken this very position :

(a) *The Impression Model or Molding Theory* (Locke, Dewey, Thordike, Gurthrie).
(b) *The Insight Model* (St. Augustine)
(c) *The Rule Model* (Kant)
(d) *The "Maieutic" or "Midwifry"* Theory (Socrates)
(e) *The Mutual Inquiry Model* (Dewey)
(f) *The Buber Model* (Buber).

A Critical Assessment of the Normative Theory

Philosophically speaking, this theory appears to be very comprehensive and hence impressive, but the realities of teaching and learning situations discovered by recent researchers in the fields of Educational Psychology and Educational Technology have revealed that in actual operational terms this Normative theory or T.L. Model of teaching fails.

Take for instance these situations:

(i) A teacher is teaching a class. He is lecturing, and only students B and D are being influenced by him, not students A and C.
—Shall we in this situation say that teaching and learning have taken place simultaneously?

(ii) A teacher is teaching his class. He is influencing the students by his teaching. But student B is being influenced directly by his teaching, whereas other students A, C and D are being influenced indirectly by him.
—Shall we say in this situation that teaching and learning have taken place simultaneously?

(iii) The teacher influence is there in his class teaching, but even then the desired learning has not taken place; the teaching-learning outcomes have remained miserably unfulfilled.

(iv) It is not necessary that in each and every teaching, there must be these four elements:

(a) Teacher, (b) Teaching, (c) Learner, and (d) Learning.

There may be a situation in which there is learning without teaching. Many self-made persons have indeed passed their examinations privately without having the benefit of college or teacher teaching made available to them.

In Programmed Learning, the physical presence of the teacher and pupil at one place in face to face situation is not there, and the learning on the part of the learner is "auto-learning."

All these limitations of this theory clearly bear out that it cannot provide a safe-landing ground for he technologists of education or researchers in the teaching-learning process.

Section IV: The Positivistic Theory of Teaching

As a matter of fact, there is not one theory a number of theories as such. But the gist of all these theories is that: "*Teaching must be viewed as teaching alone*" (Prof. K.P. Pandey). It should not be essentially analyzed in terms of learning. The "*teaching act*" itself must be positively or colourlessly analyzed, that is, without relating it to any norms, predeterminded standards, ideas, goals, traditions, etc.

The researcher is expected by this group or category of scientific theories of teaching to do a very careful, objective and scientifically rigorous observation of all that actually takes place in the process of teaching or within the pure teaching act *per se*, viz. How is the teacher presenting his subject matter? What is his style of teaching? What strategies and tactics is he using in his teaching? How many times is he illustrating his points? What are the different stages of his teaching and what operations are actually involved in each of these stages? What is their sequencing? That is, *teaching must be viewed as a "system of actions*."

O. Othanel Smith has put this very thing in these pertinent words:

> "......Analyze the concept of teaching without becoming entangled in the web of arguments about the processes and conditions of learning; in short .... carry on investigations of *teaching in its own right* ...what is needed for scientific inquiry is a concept which recognizes teaching as a distinctive phenomenon general enough to embrace normative definitions as special cases."

The Teaching Act

Pre-active phase	Interactive phase			Post-active phase
Operations	Independent Variables Teacher	Intervening Variables	Dependent Variables	Operations Variables
1. Fixations of goals 2. Deciding about contents 3. Sequencing of the ideas and styles 4. Deployment of strategies	(i) *Memory level* (L) P_t—D_t—R_t (P) P_t—D_t—R_t (E) P_t—D_t—R_t	Explanatory entities and variables	(i) *Memory level* (L) P_p—D_p—R_p (P) P_p—D_p—R_p (E) P_p—D_p—R_p	1. Defining the exact dimensions of behavioural change
	(ii) *Understanding level* (L) P_t—D_t—R_t (P) P_t—D_t—R_t (E) P_t—D_t—R_t		(ii) *Understanding level* (L) P_p—D_p—R_p (P) P_p—D_p—R_p (E) P_p—D_p—R_p	2. Selecting and using appropriate testing devices.
	(iii) *Reflective level* (L) P_t—D_t—R_t (P) P_t—D_t—R_t (E) P_t—D_t—R_t		(iii) *Reflective level* (L) P_p—D_p—R_p (P) P_t—D_t—R_t (E) P_p—D_p—R_p	3. Changing the strategies in terms of evaluations or results of tests.

An updated Version of Tolman's Model of the Teaching Act.

'This infact is a scientific approach which sociologists and other social and physical scientists adopt in their own research studies. This theory actually stands on the premise of the philosophy of "Positivism," developed by the French Philosopher Anguste Comte, the "Father of Sociology", in the 1830's.

A Pedagogical Model of Teaching

Independent Variable (Teacher)	*Intervening Variables* (Pupils)	*Dependent Variables* (Pupils)
1. L. Linguistic behaviour	*Explanatory entities and processes*, such as memories, beliefs needs, inferences and associative mechanisms.	1. L. Linguistic behaviour
2. P. Performative behaviour		2. P. Performative behaviour
3. E. Expressive behaviour		3. E. Expressive behaviour

O. Othanel Smith has added to this model by contributing the following teaching cycle in each of the three types of behaviours (L., P., E.) of the teacher as well as those of the pupils:

P (Perception) —D (Diagnosis) —R (Reaction or Achievement)

P_t—D_t—R_t P_p—D_p—R_p (t—for the teacher)
P_t—D_t—R_t P_p—D_p—R_p (p—for pupils)
P_t—D_t—R_t P_p—D_p—R_p

Professor K.P. Pandey, Ex-Dean. Faculty Education, Himachal Pradesh University, Simla, has tried to perfect Tolman's model by adding the three stages or phases of teaching—Practice, Interactive and Post-active given by Jackson, and the three levels of teaching—teaching at the memory, understanding and reflective levels. Thus on the basis of the latest theoretical formulations in the Technology of Education, the "Teaching Act" can be analyzed according to the theoretical model given on page 50.

A Critical Assessment of the Positivistic Model

The very fact that Tolman's original model was given a place of honour in the book *Towards a General Theory of Social Action,* (1952) edited by the contemporary world's two most eminent theorists in the discipline of Sociology, Professor Talcott Parsons and Professor Edward Shils, is suffice to prove that this is indeed a very sound theoretical model of teaching, acceptable to both psychologists as well as sociologists.

Moreover, during the last 40 years (i.e. since Tolman's model first appeared), as we have seen above, some solid contributions have been made to this model, and so it has become a functional or workable and impressive, sophisticated model of teaching.

However, being a sociologist of education, I am of the view that even this updated model remains incomplete unless we introduce the interplay of the following two types of sociological variables:

(1) *Extrinsic sociological variables*

Like religion, caste, class, bureaucracy, politics, economy, law, etc.

(2) *Intrinsic sociological variables*

Like peer group associations, intra-school/class factors, patterns of dominance-subordination in the classroom, social distances in the class, traditions, precedents, discipline, controlling devices, built in inertia, and social interaction processes—conjunctive as well as disjunctive processes in the class as emphasized by sociologists like Waller, Mannheim, Parsons, O.W. Swift, etc.

Of course, the introduction of these sociological variables in this model of teaching will make it very complex—perhaps too complex to become rather unmanagerable by any single researcher, yet there is no need for us to lose heart. Let interdisciplinary research team comprising of psychologists, sociologists and educationists attempt such theoretical studies. For unless we have such a perfect socio-psychological model of teaching—a really social science model for research, we would still be lagging behind in reaching the destination set by the modern Educational Technology.

Section IV: Epilogue

In conclusion, we can do no better than reproducing the following extract from a tape-recorded interview with Prof. K.P. Pandey.

"In fact, a stage has come when we are very much concerned with the development of an approach which will synthesize both these sets of theories of teaching...we must go in for the combination of both of them."

Questions

1. Suggest a suitable paradigm for the analysis of teaching act. What empirical proof will you need for this?
2. Is all that is taught learnt? If not, what steps could be taken to improve this relationship between learning—teaching?

CHAPTER VI

STRATEGIES OF TEACHING

Section I: Strategy Defined

The Collins English Gem Dictionary, (1968) defines "Strategy" as "art of war." Although this term has been popular in relation to war or battle, yet during the last few decades social scientists have started using it in the fields of social planning, teaching and human dynamics.

Let us take the meaning of 'strategy' as applied to teaching. According to B. Othanel Smith:

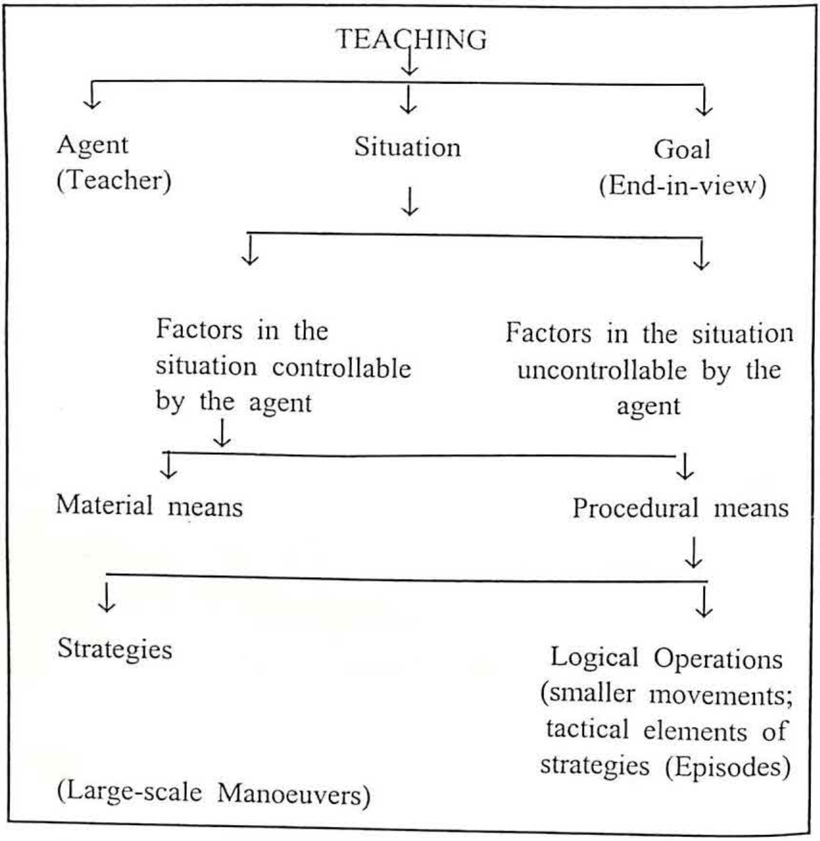
> *"The term Strategy refers to pattern of acts that serves to attain certain outcomes and to guard against certain others."*

Smith considers teaching as "a system of actions involving an agent, a situation, an end-in-view, and two sets of factors in the situation—one set over which the agent has no control and one set which the agent can modify with respect to the end in view."

The set of factors which the agent can control constitutes the means by which the end-in-view is achieved.

The means are composed of two types of factors:

(a) Subject matter and instructional paraphernalia; these are called *material means*, and


TEACHING
Agent (Teacher)
Situation
Goal (End-in-view)
Factors in the situation controllable by the agent
Factors in the situation uncontrollable by the agent
Material means
Procedural means
Strategies
Logical Operations (smaller movements; tactical elements of strategies (Episodes)
(Large-scale Manoeuvers)

THE ELEMENTS OF TEACHING (B. Othanel Smith)

(b) The ways of manipulating and manoeuvering the types of factors in (a) above; these are called procedural means.

The procedural means have two aspects:

(a) Large scale manoeuvers which are called strategies, and
(b) Smaller movements constituting tactical elements of strategies—called logical operations.

Smith divides the tactical elements of strategies into still further smaller movements which he calls episodes. Episodes are pedagogically significant units of classroom discourse. They are made up of two or more utterances, an utterance being defined as what any one individual says at a given time." In a simple episode, there is an entry and an end or close, e.g.:

Teacher : When did India become free?

Student : In 1947.

Teacher : Alright.

Episodes may also be viewed as logical operations, i.e. forms of rule-guided behaviour.

Episodes are verbal exchanges between two or more persons. These exchanges may take many different forms giving rise to two types of episodes :

(i) Episodes in which the exchange is between two persons who are *alternately responding* to each other; these are called "*reciprocating episodes*".
(ii) Episodes in which the verbal *exchange involves* more than two speakers; these are called "*coordinating episodes*."

In addition to episodes, there may be monologue or an utterance made by either the teacher or the student alone.

Another author, Ben B. Strasser, (1964) defines strategy as "A generalized plan for a lesson(s) which include structure, desired learner behaviour in terms of the goals of instruction, and an outline of tactic necessary to implement the strategy."

Section II : Use of Strategies

According to B. Othenal Smith, among the general objectives towards which a strategy may be directed the following are the most important ones:

(1) To ensure that certain learnings will be acquired in as brief a time as possible;
(2) To induce students to engage in exchange of ideas;
(3) To minimize the number of wrong responses as the student's attempts to learn a concept, principle, etc.
(4) To ensure the attainment of certain content objectives.

According to Ben B. Strasser, strategy-planning is done by the teacher before he starts teaching. Of course, he may get some ideas for future strategies while he is teaching a class. This means, that the decision of adopting which strategies or methods in teaching is taken by teachers in the planning or Pre-active stage of teaching.

A Conceptual Model of Instruction or Teaching

Let us now see how the tactics and strategies fit into the total process of teaching or instruction.

According to Ben B. Strasser, the following four aspects flow in the process of teaching a lesson in a classroom:

1. Teacher Planning.
2. Teacher's Behaviour—Initiatory.
3. Teacher observation, interpretation and diagnosis of the learner's behaviour.
4. Teacher's behaviour, influenced/influencing—influenced by the observations, interpretations and diagnosis of learner's behaviour, and influencing by way of further stimulating learner's behaviour.

" ...Strategies are in a sense, the "why" of specific teacher behaviour".

He defines tactic as "Goal-linked influenced/influencing behaviour of the teacher—the way a teacher behaves in the instructional situation in working towards the development of the strategy...."

In simple words, by strategies of teaching we mean methods of teaching.

1. In the first stage, that of planning for teaching teacher takes decisions about goals, structure and planned tactics, and thus he begins the development of the strategy.
2. In the second stage, the teacher initiates or unfolds his strategy, method or bundle of tactics in the class.
3. In the third stage, the strategies are deployed in full vigour by the teacher. Teacher's observation, interpretation and diagnosis are made in the light of the purposes for which the tactic was initiated.
4. Teacher's behaviour proceeds with tactic as planned or the tactic is modified as a result of prior observation, interpretation and diagnosis.

In relation to students's interactions, teacher may draw on responsive tactics to pull certain students into class interaction.

Ben B. Strasser rightly concludes that "the central directive element of instruction is the lesson strategy, and the essence of classroom interactions, the lesson tactics.

Section III : Strategies Used by Teachers in Class Teaching

Some of the most familiar strategies used by teachers all over the worlds are as under:

1. Lecturing Strategy

The teacher gives a long narration. This is used when the teacher is either afraid of discussing things with the students, or desirous of delivering the content in a brief time. This is not a good or effective strategy for school students, and it is not very effective for students of higher education also. But there is no escape from this due to the fact that it is easy for teachers to use it. It keeps the learners as passive learners. It cuts at the roots of healthy teacher-pupil interaction in the classroom, and develops monotony in class as there is almost a monologue on the part of teacher.

2. Discussion Strategy

The teacher can adopt the strategy of discussing the theme of his lesson by putting questions to learners, inviting questions from them, responding them, developing his lesson on the basis of their answers, and thus enable or guide the learners to thrash out the various issues or problems involved in the content. This strategy builds an active verbal interaction between the teacher and the pupils and among the pupils. Seen from sociological and psychological view-points this is indeed a very fruitful strategy of teaching provided the teacher knows that without adequate preparation or planning and mastery in human dynamics on his part, his strategy can soon fizzle out.

3. Lecturing-cum-Discussion Strategy

In many American schools and colleges and in many India universities, teachers desirous of improving their teaching adopt yet another strategy which is a combination of the lecturing-cum-discussion strategy which is now the latest strategy in teaching at higher stages of education. Evidently, it combines the best advantages of both the above strategies, but this also necessitates adequate planning, competence and confidence on the part of the teacher and his adequate knowledge of the entering and terminal behaviours of the learners. He must know what tactics to use and when, in order to meet the instructional goals and the goals of establishing healthy verbal interaction in the classroom. From the socio-psychological angle, this is the best strategy for teaching at many stages, especially at the higher stage of education.

4. Demonstration Strategy

In subjects like science, statistics, nature study and practical subjects like crafts and arts, teachers use this strategy very much.

It is invariably accompanied by verbal presentation or verbal description or exposition strategies. Effective demonstration strategy should involve the use of a smooth—flowing, chaste, interesting or motivating language which can be easily and correctly understood by the learners. It must not be drab and dry as a result of the excessive use of the technical terms and unfamiliar words above the heads of the learners. Most demonstrations fail to make the teaching a satisfying affair for both the teachers and the learners, because of many mistakes committed by the teachers—such as, demonstrating very small size models, showing unattractive models, showing incorrect things, describing the demonstrated process or thing from their side alone and not involving the learner, dampening the curiosity of the learners by asking them to keep quite or by giving very brief, incomplete or curt replies. Without a variety of tools and approaches and laboratories or workshops it is indeed difficult to communicate right sort of knowledge of the content and to have adequate type of verbal interaction in the class.

4. Discovery Strategy or Heuristic Strategy

This is popularly known as "Problem Method" in education. The teacher uses the strategy whereby the learner is placed in the shoes of an original discoverer. This is very much used in all the progressive schools of U.S.A., U.S.S.R., England and other western countries. Some enlightened teachers of science, mathematics, philosophy and even social sciences like sociology, political science and economics in India also use this strategy in some of their lessons. Needless to say, such a strategy makes very heavy demands on the parts of the teacher as well as the learner—both in terms of academic efforts and in terms of investment of resources like money, materials and time. In a country like ours where generally the whole teaching is geared to the learner's concern of just to pass in the annual examinations, neither the teacher nor the students have patience to benefit from the deployment of this strategy as such. It is indeed an ideal and most effective strategy if teachers can use it in certain situations. Of course, it cannot be used every time a teacher teaches.

5. Project Technique

The use of project method is now quite popular all over the world as a result of the writings of Pragmatists in education like Dewey, Kilpatrik, Stevenson, etc. According to Kilpatrik, "A project is a whole-hearted purposeful activity proceeding in a social environment."

Four basic elements of this strategy are:

(i) Spontaneity
(ii) Purpose
(iii) Significance, and
(iv) Interest or motivation.

While adopting this strategy of teaching, the following paradigm or order of steps has to be followed by the teacher in consultation with students at all stages:

1. Providing or creating the situation
2. Choosing the specific purposes of the project
3. Planning the project
4. Execution of the project
5. Judgement or evaluation of the Project.

It is indeed a very effective strategy of teaching. It develops social values in students and knowledge in them. According to the latest theories in the 'Sociology of Knowledge', knowledge grows very effectively as a result of their close cooperative or social participation in the spirit of democracy. It provides invaluable opportunities for correlation of various elements of the subject content, and for transfer of training or learning.

It is, however, not an easy strategy to apply. It requires dedicated, hard working, enlightened and democratic teachers, close cooperation from the reference groups of teachers—i.e. students, school authorities and parents, and adequate resources and advance planning. In Basic Education in India, this strategy had become very popular.

and now in all good public schools in India it is a much favoured strategy. Traditional schools and traditional school teachers cannot adopt this strategy in teaching as it involve a very complex interaction of sociological and psychological factors relating to teachers learners, the subject matter and the society at large.

6. Textbook Use Strategy

The teacher's asking the students to read from their book loudly or silently is quite a stereo-typed yet most popular strategy used in teaching at the school stage in many countries, especially in India where teachers, who shirk doing hard work, teach subjects like General Science, Commerce, Geography and even Geometry by this strategy and thereby make a complete mess of teaching. Such a strategy of using textbook is only a means to an end, but unfortunately in our country it has become an end in itself at the hands of many such teachers. Lack of lucidly and clearly written and properly illustrated books containing factually written up to date content in India has, in ultimate analysis, defeated the very purpose of this strategy and reduced it to the level of an inert or lifeless strategy. Most textbooks brought out by State Boards of Education and private publishers in India provide no attractive feast to the eyes of the learners, and so when the teacher asks the students to read books in course of his teaching the latter cooperate most unwillingly. Most of the school textbooks in India are written by professors, educational administrators and the so-called educational research workers who have no actual touch with the school classes. And hence many of the textbooks are of little functional use in the teaching learning process directed by the teacher. Unless a functional teacher's handbook to use the prescribed textbook is provided to the teacher or is consulted by the teachers, or unless a functional textbook or supplementry edited book is developed by the teacher, the deployment of this strategy of teaching will continue to remain an unsatisfying thing.

7. Reviewing Strategy

Review or recapitulation strategy is a strategy used invariably by all good teachers, whether they are teaching in a classroom or writing programmed texts for outside students. A lot of understanding and care on the part of the teacher is called for at this stage, for this strategy is going to provide his experiences as feedback for the deployment of further strategies in teaching next lessons.

8. Assignment Strategy

In the classroom itself, the teacher may give assignment or exercises to be done by the students under his supervision. It is a good strategy if the teacher is able to provide individual supervision or guidance to each pupil, and if there is sufficient time available for teaching. If the exercises given to the students are very easy or very difficult, they may instead of presenting challenging learning situations before and the learners, lower down their interest for learning teacher's enthusiasm may also wane ultimately.

Section IV: Epilogue

Each of these strategies employed by teachers all over the world result in a threefold particular pattern of teacher and pupil behaviour:

(1) Verbal interaction
(2) Social interaction or interaction in the "effective domain" which creates "social climate of the classroom."
(3) Other interaction.

These strategies involving various tactics and episodes determine whether, when and how effective "direct teaching" and "indirect teaching" will be organized in the classroom.

Questions

1. Why do modern teachers use certain "strategies" in their teaching? How do these "strategies" help the teacher in organizing an effective teaching?

2. Discuss the concepts of "strategy", "tactic" and "episodes" as applied to teaching in schools.

3. "The lesson strategy is part of a larger development scheme-the curriculum" (Ben B. Strasser). Discuss.

4. Discuss the importance of "strategy in teaching" in building a theory of teaching.

CHAPTER VII

TEACHING AND LEARNING AT DIFFERENT LEVELS

This chapter is divided into three sections:

(i) Teaching-Learning at Memory-Level.
(ii) Teaching-Learning at Understanding-Level.
(iii) Teaching-Learning at Reflection-Level.

As we know teaching-learning situations are of diverse nature and of diverse levels of sophistication and significance. They may be put along a continuum or scale ranging from "thoughtless" to "thoughful." Psychologists like Morris L. Bigge and Maurice P. Hunt have tried to divide all these kinds of teaching-learning situations into three broad classifications: memory-level, understanding-level, and reflection-level, considering that the memory-level is the most "thoughtless" and reflection-level most "thoughtful."

Although this sort of classification of teaching at three levels has been contributed by the T-L Theory (Teaching-Learning Theory) of teaching, yet it is now accepted by other theories of teaching also.

Section I: Teaching and Learning at Memory Level

"Memory" says Floyd L. Ruch (*Psychology and Life*, 1970), is a measure of the individual's ability to recall and associate previously learned items."

Teaching aimed at causing learning at the memory level is expected to be such that may enable the following four phases of memory learning occur :

1. Learning: Acquisition or Impression
2. Retention
3. Recall or Reproduction
4. Recognition.

Meaning of teaching at Memory level

When a teacher (i) has a definite frame work
(ii) builds a definite structu
(iii) gives a specific content.

we say that his teaching is pitched at affecting or causing memory-level learning. The expected outcome or purpose of this level of teaching is that the learner will show the specific knowledge structure at the time of testing.

The three features of this kind of teaching-learning are :

(i) Definiteness
(ii) Predictability
(iii) Observable specified knowledge structures.

Some critics hold the view that memory level teaching is in fact "indoctrination."

This is a wrong view, because in each discipline there are always certain areas of knowledge where memory level learning has to take place. Indoctrination means regimentation or closing down. But if a teacher is imparting certain knowledge in order to develop knowledge of the learner, it is not indoctrination. For example, Sanskrit scholars in India have been teaching classics at the memory level through the centuries emphasizing the learners to learn the *dhatus* and other such word structures by rote, but their purpose has been to sharpen the processes of recall and recognition, and also to develop creativity in the learners.

1. Motivation

Motivation at the memory level teaching is purely extrinsic. It is built through a system of rewards and punishments through observable materialistic presentation. If the learner is properly motivated, teaching at the memory level can be effective.

2. Testing

In memory level learning, teachers give essay type as well as new type (or objective) tests. In both these, recall and recognition, that is reproduction of the materials learnt, are desired.

3. Role of the Teacher

In such a teaching, the teacher is more active and authoritarian. The whole job of structuring and systematic or logical presentation of content in the class is that of the teacher. The teacher imposes the structure of knowledge on the learners and expects them to reproduce it later on. Most of the programmed Learning also emphasizes memory level teaching-learning. The teacher or programmer does a lot of spoon-feeding to the learners.

4. Role of the Learner

The learner is reduced to the level of a passive partner in the educational process. He is merely a receiver of knowledge.

Although some sort of content of knowledge is passed on by the teacher to the students in a class, yet the students may reproduce the same thing in different ways or forms, for each individual has his different set of abilities, a different processing data, and a different repertoire. Once a teacher, book, lecturer or programmed material throws a certain unit of knowledge in a learner's mind, various kinds of learning can occur. In unmotivating situations, even highly creative learners tend to become truants.

5. "The more meaningful the material learned, the longer it will tends to be retained."[1]

6. There is not necessarily any relationship between the capacity to memorize and retain material relationship to the capacity for intelligent behaviour.

7. "Memory-level teaching may, of course, contribute indirectly to intelligent behaviour."[2]

In his "Learning Theories for Teachers", Morris L. Bigge, says, "It no longer is a matter for speculation that not much objective way of durable or useful results can be expected from memory-level instruction. Its contribution to intelligent behaviour is too unpredictable and independendable for us to set much store by it is a favoured instructional procedure."[3]

8. In spite of its several defects mentioned above, it will be wrong to think that memory-level teaching can be avoided by most teachers. When the teachers have very less time, they cannot do without it. In Mathematics, languages, geography, science and subjects like these, habit memory has to be emphasized. Therefore, due efforts should be made to devise conditions under which memory-level learning can work very effectively such as the following:

    (i) Repetition should be rhythmical.
    (ii) Frequent recall or reproduction of the content should be demanded.
    (iii) Improved methods of handling the material should be used.
    (iv) Fatigue should be avoided.
    (v) Spaced revisions should be made.
    (vi) Whole method should be used.

(vii) Material should be meaningful.

(vii) Material should be presented in a manner that will motivate the learners.

(ix) All parts of the material of the lesson should be well integrated.

(x) "Reminiscence" and "Preservation" should also be emphasized.

9. Due to factors of interest, age and material, wide differences are generally found among individuals as regards to memory.

10. According to Shiffrin and Atkinson[4] (1969) human memory resembles the system developed in high, speed digital computers to store information in region called "buffer", and permit its recovery and use at a later time. Hart says that the human brain is like a library with plenty of books but a poor card catalogue.

11. According to Gange, "For purposes of learning relevant to the school, a most important set of questions concerning remembering centres about the effect of the passage of time."

12. Retention of classroom material can be increased by later use of the material learned.

13. Researchers like Hebb and Dungon have presented the hypothetical process of consolidation by which the fragile and unsustained "recent memory" process is converted to a long-lasting memory storage. Teachers must know how this process of consolidation can be achieved effectively.

14. A number of experimental studies have shown that older memories generally survive a variety of treatments including cooling of the brain, electro-convulsive shock (ECS) and administration of drugs. Hence teachers should try to see to this point also.

Section II: Teaching And Learning at Understanding Level

Psychologists, Morris L. Bigge and Murice P. Hunt are of the view that "understanding" has two aspects :

(i) *"Seeing relationship:* seeing solitary facts in relation to a general principle."

(ii) *Seeing the tool-use of a fact:* "as soon as a person sees what something i for, he understands it."

Combining these two aspects, they have given this definition of understanding:

> *"Understanding occurs when we come to see how to use productively, in ways which we care about, a pattern of general ideas and supporting facts."*

In other words, we can say that when we are able to find out the whole relationship between the items or when we have been able to make out a sense from given material, understanding has taken place.

Implications of teaching and learning at understanding level

Bigge and Hunt approvingly quote the following key ideas of Henry C. Morrison, Professor of Education, University of Chicago, (1919-1937) about understanding level of teaching and learning:

1. Morrison emphasizes idea-centred associationism.
2. Schools should promote the learning of personality adaptation. The proper task for education is to emphasize the creation of true adaption, which is a permanent change in outlook or which is "personality change."
3. By understandings we mean generalizations, rules, principles, concepts which suggest "if—then" relationship. Thus an understanding is not merely a generalization based on certain facts or data, but it is insight into how it may

be applied in unknown situations in future.

4. Mastery of facts must be emphasized in a teaching-learning situation. This can be accomplished by dividing each subject field into "psychological units of work." A unit, according to Morrison, is generalization and its related facts, as a student should come to see them.
5. Stages or steps of teaching-learning at understanding level.

I. Exploration

Explore the background knowledge or level of understanding of the learners by testing, questioning, or discussion. This step should help the learners to arrange the subject-matter not in a logical order but in a "psychological sequence." It should be of help to the teacher also by way of providing orientation or a sense of direction in deciding how a new unit of knowledge should be presented.

II. Presentation

The teacher should then present the new knowledge briefly. Until all the learners have fully understood what they have covered up to a certain point, no new step should be taken.

III. Assimilation

Let the learner assimilate or thoroughly master the subject content presented to him by his individualized work in the classroom, library, laboratory of field trip, under the supervision of the teacher. Morrison suggests the use of problem-centred guide sheets.

At the end of each unit, the student should be made to take a "mastery test" to show how far he has grasped the understandings of the content of knowledge items presented to him. This test should require some sort of application of principles learnt to novel situations.

IV. Organization

The student should be asked to reproduce the essentials or the basic things of the unit in writing without taking any help from books, notes, teacher etc. In certain subjects like Arithmetic, Grammar etc., this stage is unnecessary and so it can be eliminated.

V. Recitation

By this, Morrison means the stage wherein each learner presents a summary, gist or condensed version of the understanding taught in the lesson unit, to his teacher and classfellows. Rectation can also be in the form of a written paper.

6. A Critique of Morrison's Paradigm of Understanding Level Teaching-Learning:

On the Positive Side :

(i) Morrison's steps are indeed psychological and functional to an effective teaching-learning at understanding level.

(ii) His concern for "thoroughness" or "true learning" is to be commended.

On the Negative Side

(i) Morrison's paradigm of the steps of understanding is impressive, but many vested interests in our society hinder the reorganization of curricula in schools so that true learning is not achieved.

(ii) Morrison seems to have ignored the utility of teacher's motivating the students by promoting their personal involvement with the subject. The teacher should try to promote "ego-involved learning" in his class, so that the learners start developing structures on their own.

(iii) Although Morrison has talked a great deal on reflection on the part of the students, in actuality he has laid great emphasis on answers rather than on issues.

(iv) For understanding level teaching-level, unrestricted provision of time and complete autonomy to the teacher are two important prerequisites. It is doubtful whether these could ever be made available in most of our traditional school.

(v) Although understanding-level teaching gives students a tool for more intelligent behaviour, and it is better than memory-level teaching, yet we must not forget that even this "may be highly uncritical and authoritarian. Further more, the principles taught by the teachers may be wrong and sometimes are.....*it does not carry with it the quality of experience needed to enhance intelligence to its fullest potential.*" (Bigge).

7. *Some Other Aspects of Understanding-Level Teaching-Learning;*

(A) Motivation

The source of motivation in it is not only extrinsic but also intrinsic. The teacher works at the level where the teacher can develop different self-images in the learners. His skill lies in putting the learners in the "ego-involved learning" situations wherein they could themselves try to learn and understand by doing a very hard and devoted work.

(B) Testing

Simple paper-pencil tests are of not much avail in it. Banjamin Bloom has suggested that at this level of teaching the teacher can give matching type of questions, multiple-choice type questions in order to judge or assess whether understanding of the units presented by him to the learners has actually taken place or not. Novel situations—hypothetical or real situations, must be presented in the tests, whether they are written tests as oral tests.

(C) Role of the Learner

Care should be taken to see this that learner remains very active in it, constantly developing new knowledge and affecting his "personality-changes" as Morrison desired.

(D) Role of the Teacher

Teacher should be cautious enough to see that he does not drift into be coming an authoritarian and haughtly director of the teaching-learning process in the classroom. He should be a democratic leader like a head scientist in a research organization guiding, motivating, helping, supporting and supplementing his fellow scientists in the great cooperative venture of discovering and mastering the truth-in what even forms or shades it is be found. Flexibility, dynamism, human touch, understanding, patience and faith in the learners are the qualities absolutely necessary for a teacher who is desirous of teaching at understanding-level.

Section III: Teaching and Learning at Reflection Level

Reflection-level teaching is that teaching which is problem-centred in nature in which the learner is engaged in original, imaginative and critical approach to the subject and does a deep or serious kind of thinking. The learner examines facts and generalizations and seeks out new ones.

Bigge's comments on such teaching are most pertinent :

"Reflective teaching tends to the development of a classroom atmosphere which is more alive and exciting, more critical and penetrating, and more open to fresh and original thinking. Furthermore, the type of enquiry pursued by a reflective class tends to be more rigorous and "work producing" than pursued at an understanding learning situation."

Let us now analyze the four components of reflection:

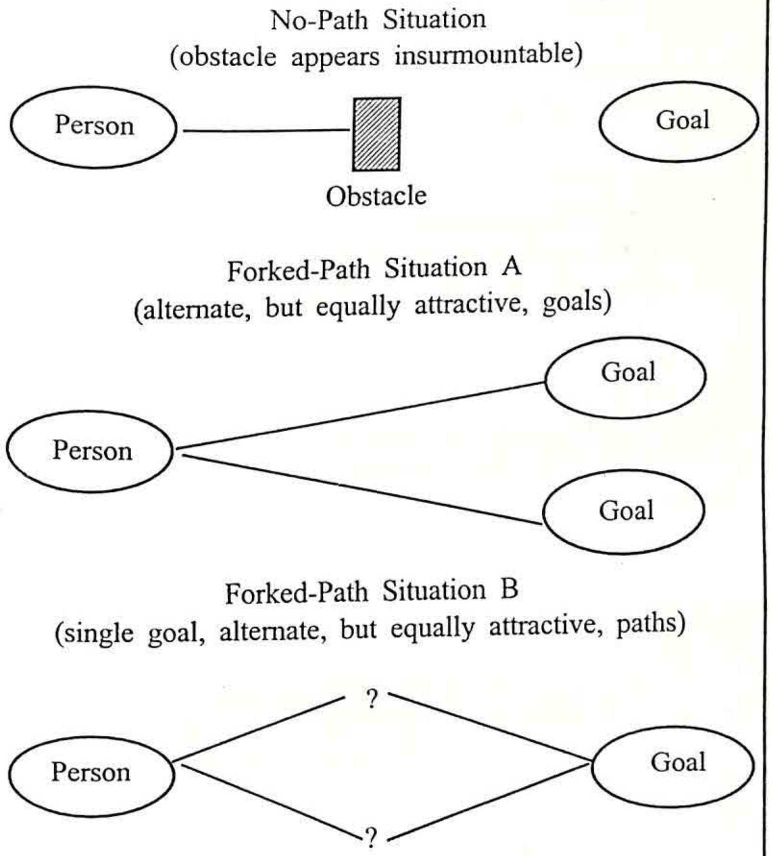

No-Path Situation
(obstacle appears insurmountable)
Person
Obstacle
Goal
Forked-Path Situation A
(alternate, but equally attractive, goals)
Person
Goal
Goal
Forked-Path Situation B
(single goal, alternate, but equally attractive, paths)
Person
?
?
Goal

Fig 11.1 ***Dewey's Problematic Situations.***

(1) Problematic Nature

A learning problem must become a psychological problem in nature for the problem. It must involve or create psychological tension in the learner's mind. Not others but his own problem is really a psychological problem for him. The art of the teacher lies in posing a problem related to learner or related to others in society in such a manner that the learner accepts it as a challenging psychological problem for him. He begins to find himself in a tension as to how the goal will be reached.

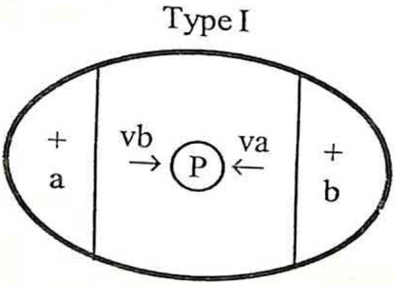
There are two aspects of the problem-centred nature of reflective teaching-learning process :

(A) *Problem-raising aspect*
(B) *Problem-solving aspect.*

1. The learner must be made to feel dissatisfied with one or more of his existing ideas, values, beliefs, or items of knowledge. The inadequacies and disharmonies of outlooks or insights must be discovered.

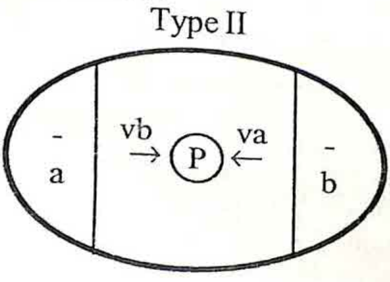
2. Introduction of dissatisfaction present a non-path or a forked situation as indicated by John Dewey. Psychologist Kurt Lewin has tried to pose the problem in the following manner:

I. Situation



A person has two conflicting goals or two opposite regions of his life-space—both of positive valence. He like a ball being pulled in opposite directions, usually will remain in the field. He will remain engaged in the problem trying to solve it.

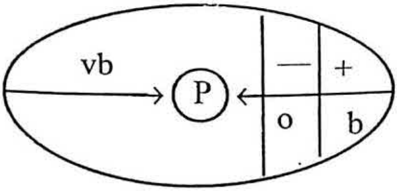
II. Situation



The person is faced with two opposite significant regions of his life-space, each having a negative valence. He wants to escape but i is impossible. He is between the devil and the deep blue sea.

III Situation

Type III



A region of positive valence and a region of negative valence are in the same psychological direction from the person. They are functionally similar.

In order to raise the problem successfully, the teacher must know :

(i) to use a "subject matter switch."
—while generalizing he shows how a further thought is incompatible with the principle, and, hence, with the first idea.

(ii) *to introduce "disturbing data":*
—data outside the learner's life-spaces, capable of making them doubt their existing ideas, attitudes or beliefs.

(iii) *to permit students to make mistakes:*
—letting the students to do things in their own way and reaping their consequences. The learners will naturally like to put tools of questions, but the teacher should refuse to offer fixed answers. Till right questions are raised, the "unknown" in the problem remains hidden.

(2) Steps in Problem-Solving

(i) Helping the learners to feel the problem.
(ii) Encouraging the learners to formulate as many hypotheses or questions as possible.
(iii) Encouraging the students to examine the hypotheses or answer the questions with the help of all available data.

Overall Characteristics of the Reflective Level Teaching-Learning

1. Thoroughness.
2. Orderliness.
3. Length of time depending on learner's age and maturity.
4. Movement of the learner frequently from problem to hypotheses to evidence to conclusions in varying order.
5. Discussion - public as well as private.
6. Teacher's providing an atmosphere of mutual enquiry.
7. Reflective level teaching suitable for all subject-teaching situations where there is unique relationship between teacher and the students.
8. Unsuited to rigidities like use of textbooks.
9. Advantageous to learners of high ability as well to those of low ability.
10. Increases motivation in learners.
11. Advocated for small groups of learners.
12. Unpredictable outcome.
13. Originality.

SOME VITAL ASPECTS OF TEACHING AT REFLECTIVE LEVEL

1. Motivation

Motivation of a very high instrinsic source is needed. The learner has to be made problem-minded. Unless he develops the sense of oneness with the problem, no reflection is possible. Motivation is built by standards of self or self-concept, prestige, feeling of involvement, identification with high values. Ego-involvement learning must be promoted. Scientists and original discovers neglect many physical needs and pleasures while engaged in reflective level learning. In classrooms, we do not want to introduce such extreme sacrifices but at least some twinkle of reflection should come in one's teaching. The main source should not be the teacher, but the learner himself.

2.Role of the Teacher

He must be insightful, tactful, reflective, creative and a toughman to insist on that the right questions about the problem are first raised and then they are solved cooperatively by the teacher and the learners. He may be in the background, but he has to play a very active role.

3. Learner

He must be very active, intimately involved in the problem and must be sincere in his efforts. He may be perplexed but he must not be confused.

4. Testing

The outcomes of reflective level of teaching are not easy to test or evaluate. The basis should not be the usual type of paper-pencil tests, but what the learner has actually done. Protective techniques of assessing human personality may be used. Reflective or problem-centered essays may be given.

Questions

1. What are the 'Levels' of learning and teaching? Discuss any one such level in details.
2. "Reflective teaching is problem-centred teaching". (Bigge) Discuss the statement.
3. How can teaching be organized at memory-level?
4. Discuss the differences between understanding level and reflective-level teaching and learning in respect of motivation, testing, context, and roles of the teachers and the students?
5. Describe learning outcomes and teaching operations either at memory level or at reflective level of teaching.
6. Do you think there are differences in the methods of teaching at different levels of presentation? Write by bringing out the reasons for organizing teaching at three levels.

References

1. Bigge, Morris L. and Hunt, Maurice P., *Psychological Foundation of Education*. New York, Harpar & Row, (Harper International Student Reprint) 1965, p. 429.
2. *Ibid*, p. 430.
3. Bigge, Morris L., *Learning Theories for Teachers*, Delhi, U.B.S. Publishers, 1967, p. 317.
4. Quoted in : Mathis *et al.*, *Psychological Foundations of Education*. New York, Academic Press, 1970.

CHAPTER VIII

TAXONOMY OF EDUCATIONAL OBJECTIVES

Section I: Introduction

The term "Taxonomy" means classification. When applied to education, it means a systematic classification of educational objectives or goods. It may be of great help to educational administrators, specialists and teachers who are eager to discuss clearly the educational goals, assess students' performance in examinations, and evaluate their participation in various co-curricular activities with a great deal of precision or exactitude.

Taxonomy of educational objectives is based on three sorts of principles :

(i) Educational principles.
(ii) Logical principles.
(iii) Psychological principles.

The whole of human knowledge has been divided into three areas or domains :

(1) Cognitive Domain

It includes objectives dealing with the *recall or recognition of knowledge and the development of intellectual abilities and skills.*

(2) Affective Domain

It includes objectives which describe changes in interests, attitudes and values, and development of appreciation and appropriate adjustments.

(3) Psychomotor Domain

It includes manipulation or motor-skill area.

Benjamin S. Bloom and a number of American College teachers and University examiners have done some solid work in the development of these domains. Main contribution are as under:

1. Bloom B.S., *et al* (Eds.). *Taxonomy of Educational Objectives* (Handbook I: Cognitive Domain). New York, David Mckey Co., 1964.
2. Krathwohl, D.R. *et al*, *Taxonomy of Educational Objectives* (Handbook II: Affective Domain). New York, David Mckey Co., 1964.

They have so far not produced their Hand book on the Psychomotor domain. But E.J. Simpson has attempted an exposition of this domain as we shall see in the next section.

Section II: The Three Demands

We shall now see in the table in the next page the various domains of the taxonomy of educational objectives in some detail.

(A) COGNITIVE DOMAIN

Major Categories	Illustrative General Instructional Objectives	Illustrative Behavioural Terms for Stating Specific Learning Outcomes
1	**2**	**3**
1. Knowledge:		
i.e., remembering the previously learnt materials	knows: Common terms specific facts methods, procedures, basic concepts and principles.	Defines, describes, identifies, labels, lists, matches, names, out-lines, reproduces, selects, states.
2. Comprehension		
i.e. ability to grasp the meaning of material	Understand facts & principles; interpret maps & charts; translate verbal material to mathematical formulas; estimate future results or trends; justifies methods and procedures.	Converts, defends, distinguishes, estimates, extends, generalizes, gives examples, infers, paraphrases, rewrites, summarizes.
3. Application:		
i.e. ability to use learned material in new and concrete situations.	Applies concepts and principles to new situations; applies laws and theories to practi-	Changes, computes, demonstrates, discovers, manipulates, modifies, operates makes, prepares, pro-

1	2	3
	cal situations; solves mathematical problems; draws charts and graphs; demostrates correct usage of a method or procedure.	duces, shows, solves, uses.
4. Analysis		
i.e., ability to breakdown material into its component parts for understanding.	Recognizes unstated assumptions and logical fallacies in reasoning; distinguishes between facts and inferences; evaluates relevance of data; analyses the organizational structure of a work (like art, music, writing).	Breaks down diagrams, differentiates, discriminates, identifies, illustrates, infers outlines, points out relates, selects, separates, subdivides, distinguishes.
5. Synthesis		
i.e., ability to put parts together to form a new whole.	Writes a well organised theme; gives a well organised speech; writes a creative story or poem; proposes a plan for experiment, integrates learns from different areas into a plan; formulates a new scheme for classifying objects, events or ideas.	Categorises, combines, composes, creates, designs, explains, generates, modifies, organizes, plans, rearranges, reconstructs relates, reorganizes, revises, rewrites, tells, writes.

1	2	3
6. Evaluation		
i.e., judging the value of material for a given purpose.	Judges: the logical consistency of written material; the adequacy with which conclusions are supported by date; the value of a work by use of internal criteria; the value of a work by use of external standards of excellence.	Appraises, compares, concludes, contrasts, criticizes, describes, discriminates, explains, justifies, interprets, relates, summarises, supports.

(B) AFFECTIVE DOMAIN

1. Receiving		
i.e., student's willingness to attend to particular stimuli or phenomenon.	Listens attentively; shows awareness of importance of learning; shows sensitivity to human needs and social problems; accepts differences of race and culture; attends closely to the classroom activities.	Asks, chooses, describes, follows, gives, holds, identifies, locates, names, points to, selects, sits erect, replies, uses.
2. Responding		
i.e., active participation and reaction on the part of the student.	Completes assigned homework; obeys school rules; participates in class dis-	Answers, assists, compiles, confirms, discusses, greets, helps. tables, per-

1	2	3
	tinction; completes laboratory work; volunteers for special class; shows interest in subject, enjoys helping others.	forms practices, recites, reports, selects, tells writes.
3. Valuing Concerned with the worth or value a student attaches to a particular object, phenomenon or behaviour.	Demonstrates belief in the democratic process; appreciates good literature, art or music; shows concern for the welfare of others; demonstrates problem-solving attitude; demonstrates commitment to social improvement.	Completes, describes, differentiates, explains, follows, forms, initiates, invites, joins justifies, proposes, reads, reports, selects, shares, studies, works
4. Organization: Concerned with bringing together different values, resolving conflicts between them, and starting to build an internally consistent value system.	Recognizes the need for balance between freedom and responsibility in a democracy; role of systematic planning in solving problems accepts responsibility for his own strengths and limitations; formulates a life plan in harmony with his abilities, interests and beliefs.	Adheres, alters, arranges, combines, bines, compares, completes, defends, explains, generalizes, identifies, orders, organized, prepares relates, synthesis.

1	2	3
5. Characterization by a value or value complex: Value system controlling his behaviour already established so that he has now a life-style of his own.	Displays safety consciousness; demonstrates self-reliance in working; co-operates in group activities, observes objectivity in problem-solving; shows industry, punctuality and self-discipline; maintains good health habits.	Acts, discriminates, displays, influences, listens, modifies, performs, practices, proposes, qualifies, questions, revises, serves, solves, uses, verifies.

(C) PSYCHO-MOTOR DOMAIN

(Levels According to E.D. Simpson, 1967)

	Examples	
1. Perception i.e., process of becoming aware of the objects, qualities or relations by his sence organs.	Writes smoothly and legibly; accurately reproduces a picture sets up a laboratory equipment quicky and correctly operates a sewing machine skilfully; performs a dance step correctly; drives scooter correctly; skilfully plays on a violin; types	Assembles, builds, changes, cleans, composes, corrects, constructs, designs, dismantles, drills, drives, fastens, fixes, heats, locates, makes, manipulates, mends, mixes nails, paints, saws, sharpens, sets. sketches, starts, stirs, types, weights, warps.
2. Set: i.e., preparatory adjustment for a particular kind of activity or experience.		

1	2	3
3. Guided Response: i.e., avert behaviour of the learner under the guidance of another person.	errorlessly at high speed.	

Section III: Epilogue

Some apprehensions, doubts or criticisms have been raised against the taxonomies of educational objectives as outlined in the preceding section. The main criticisms are as under:

1. These taxonomies seeks to fragment or separate into particular, artificial categories of learner's behaviours.
2. Classroom teachers may not be able to master and use them so meticulously, and so, they may remain merely as a pedagogic rhetoric.
3. There are a number of cases of over-lapping of the general as well as specific learning outcomes in these three taxonomies.

While the first criticism may be correct to an extent, it is an undisputed fact that the teachers are greatly helped in making their teaching more pointed and more relevant with the help of the knowledge of these taxonomies. Given due motivation, understanding and practice, the school teachers will indeed be able to use them effectively. The overlappings are bound to be there but efforts are always directed towards making dustinctions among the different taxonomies and the general and specific outcomes falling under each of them as clear as possible.

Let us not forget that, after all, this sort of attempt at systematization of all human knowledge has started in our country in the last three decades. In the years to come, we do hope that more and more educational researchers, technologies of education and educational technologists of education and educational practitioners with be interested in them, and thus the prospects of improvement of education in terms its objectives, methods of instruction and testing of devices are indeed very bright in India.

Questions

1. The first step in a systematic approach to instruction is unquestionably the specification of objectives in operational terms." (Popham and Baker). Discuss the statement.
2. Discuss Bloom's Taxonomy of educational objectives in brief.
3. What are the various levels of learning in the cognitive domain?

CHAPTER IX

ANALYSING VERBAL INTERACTION IN A CLASS

Section I: Class Room Inter-action Analysis

Optimum educational effectiveness depends upon what goes on in the classroom and how it goes on. Hence, it is necessary to discover all that goes on in the classrooms and stream-line the same along certain desirable dimensions in order to make teaching effective.

All that goes on in the classroom, that is, classroom interaction, may conveniently be divided into two parts for the sake of analysis:

1. *Verbal Interaction:* It involves the influence of the teacher on the students and of the students on the teacher through verbal statements.
2. *Non-verbal interaction:* The actions or gestures through which the teacher teaches a certain subject-content come under non-verbal interaction.

Verbal interaction very largely determines the social interaction or social climate of the class, and it determines in large measure whether the teaching is going to be effective or not, whether the non-verbal interaction involving the delivery of subject-content is going to be accomplished successfully or not.

Hence efforts have been made by some researchers to evolve a technique to analyse and quantify the verbal interaction in a class room. Since in this technique certain categories of class room interaction are identified, this is known as VICS (Verbal Interaction Category System).

Ned Flanders involved a VICS consisting of 10 categories. Some others like Edmund Amidon and Elizabeth Hunter have advocated a VICS consisting of 12 categories. There are some other researchers who have presented a VICS having 16 categories and that is indeed a very complex VICS. However, it must be pointed out that Ned Flander' VICS has been the back-bone of all these VICS for analysing verbal interaction in classrooms. Hence we shall discuss this very VICS in this chapter.

Section II: Flander's Verbal Interaction Technique

It is an observation technique in which the observer has to do careful and objective observation and decide which verbal statement of the teacher and the pupils will fall into which category.

The observer sits in the classroom at least for 20 minutes and during this period he has to write the numbers in a column according to the 10 categories given by Flanders, as a record of the verbal interaction going on in the class before him. Each number should be marked in about 3 seconds, that means, about 400 numbers would be marked in 20 minutes. He has to decide which category best represents the communication event completed in 3 seconds.

First all, the Following basic information points are noted down on the observation sheet by the observer.

1. Date ....
2. Period ....
3. Time ....
4. Subject ....
5. Name of the teacher.........
6. School ....
7. Class ....
8. Topic ....

Then the numbers are written in columns on a plain paper by the observer according to the following 10 categories of verbal interaction given by Flanders. The observer should also note down separately any additional facts which might appear to be significant for analysing the verbal interaction in the classroom.

Flander's Ten Categories For Interaction Analysis

Teacher Indirect Talk. (a) Influence	1.	*Accepts Feeling:* accepts and clarifies the feeling tone of the students in a non-threatening manner. Feelings may be positive or negative. Predicting or recalling feeling are included.
	2.	*Praises or Encourages:* praises or encourages students, action or behaviour. Jokes that release tension, not at the expense of another individual, nodding head or saying "yes" or "go on" are included.
	3.	*Accepts or Uses ideas of student:* clarifying, building or developing ideas suggested by a student. As teacher brings more of his own ideas into play, shift to category five.

	4.	*Ask questions:* asking a question about content or procedure with the intent that a student answers.
(b) Direct 5. influence.	5.	*Lecturing*: giving facts or opinions about content or procedures; expressing his own ideas, asking rhetorical questions.
	6.	*Giving directions*: directions, commands, or orders with which a student is expected to comply.
	7.	*Criticizing or justifying authority*: statement intended to change students behaviours from non-acceptable to acceptable pattern; bawling some one out; stating why the teacher is doing what he is doing; extreme self-reference.
Student Talk	8.	*Student talk*: response; talk by student in response to teacher. Teacher initiates the contact or solicits student statement.
	9.	*Student talk*: initiation: talk by student which they initiate. If "calling on"

student is only to indicate who may talk next, observer must decide whether student wanted to talk if he did use this category.

10. Silence or confusion pauses, short periods of silence and periods of confusion in which communication cannot be understood by the observer.

When about 400 numbers in 20 minutes have been marked, the observer leaves the class and does chaining or pairing of the numbers as under :

XQ 10] 8]
[5 [5
5] 4]
[10 [8
5] 5]
[5 [5
5 9
Q] 5]

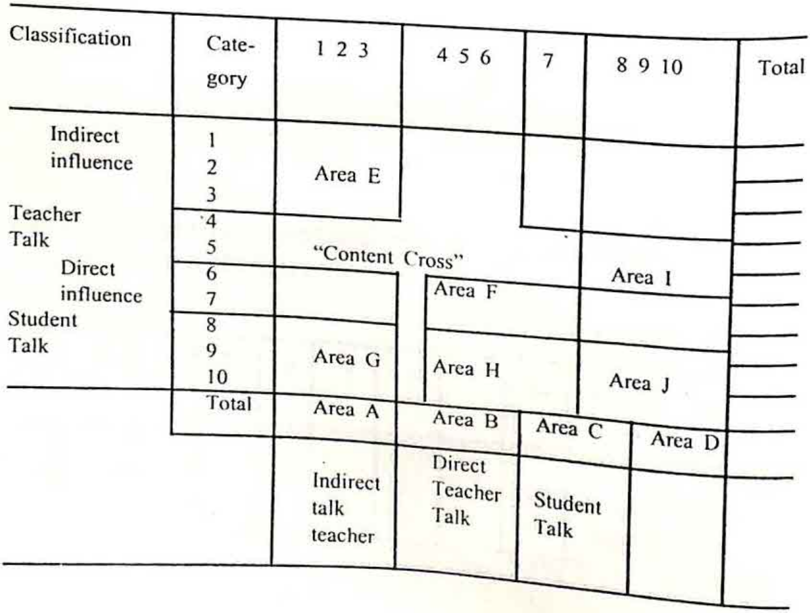
Then these chains or pairs are represented on a tally-sheet like this: e.g. for pair 10-5, take 10th category vertically and 5th category horizontically.

Category.	1	2	3	4	5	6	7	8	9	10
1										
2										

Category.	1	2	3	4	5	6	7	8	9	10
3										
4										
5										
6										
7										
8										
9										
10										
Total.										

Then total of the tallies in each square or cell in the above tally (–) sheet is written. On the basis of these totals, the following sort of Analysis Martix is prepared.

MATRIX ANALYSIS



In each of the cells indicated in the Matrix, total number of tallies are written. And then with the help of these cells, the direct and indirect influence of the teacher, pupils' dependent and independent acts and confusion are analyzed and interpreted in terms of percentages. For example, some of the points of interpretation discovered by us in a classroom interaction analysis by this technique were as under :

1. The proportion of teacher talk and student talk was found to be 300 : 120 = 5:2
   It means the time taken in teacher talk was two times and a half more than the time taken in student talk. It shows that the teacher was dominating the class, and the participation by the students was very less.
2. The teacher was asking a lot of questions and the students' response was also quite good, but student initiative was indeed very less.
3. The teacher neither accepted the feelings of the class nor appreciated or praised the students. He was impatient to lecture all the time to the class.

Further interpretations like these can be done.

Section III: Epilogue

This sort of verbal interaction category system (VICS) is indeed very useful for improving the classroom interaction on which the classroom social climate and teacher effectiveness largely depend. Hence, in teacher education this system makes a valuable contribution. This technique seems to uphold teaching as an act in itself, as the Positivistic Theory of teaching implies. We are in full agreement with Edmund Amidon and Elizabeth Hunter (*Improving Teaching*, 1967) when they comment :

> "The VICs is not a confirming system, not a "teaching by numbers" receipe. Rather it is designed to free teachers so that they may choose their verbal behaviour according to what they wish to accomplish."

QUESTIONS

1. How can you analyse the verbal interaction in a school class? What is its importance in education?

2. Discuss the ten categories in the Flanders' Verbal Interaction Category System, and briefly illustrate how they are interpreted.

3. It is said that "VICS liberates practitioners from teaching that is too often initiative or instructual rather than thoughtful and original". How far is it correct?

4. Explain the Categories recommended by Flanders for indirect teacher talk. How are these categories related to student talk? Mention the limitations of Flanders' interaction analysis procedure for encoding classroom interaction.

CHAPTER X

RELATIONSHIP BETWEEN TEACHING AND LEARNING

Section I: Introduction

Before trying to examine their relationship, let us see what the terms teaching and learning stand for. *"Teaching is a form of interpersonal influence aimed at changing the behaviour potential of another person"*. (American Educational Research Association Committee on the Handbook of Research on Teaching.) In another words, it is an influence-directed activity; it seeks to influence the learner with a specific content structure."

"Learning is a relatively permanent change in a behavioural tendency and is the result of reinforced practice."(Kimble and Garmezy).

In the next section, we shall discuss the relationship between these two concepts.

Section II: How Teaching and Learning are Inter-related

This subject of the relationship of teaching and learning cuts across all the topics, themes or problems one comes across in the disciplines of Educational Psychology, Sociology of Education and more so of Educational Technology. We shall simply indicate the points of their relationship although a lot of patient research for decades has gone into the emergence of this sort of relationship.

1. The T.L.Theory (Teaching-Learning Theory) which emphasizes that teaching and learning invariably go together is now longer recognized today. On the other hand, the prevailing theory is the "Positivistic theory of Teaching" which emphasizes that a teaching act should be examined in its own right, free from its relationship with learning. Many current researches in the growing field of Educational Technology stand on this very premise.

2. Even then, it must be emphasized that the merits of the T.L. Theory have not been completely overthrown by educational psychologists and educational technologists, because after-all teaching seeks to change the behaviour of the learner. B.O. Smith's definition of teaching that it *"is a system of actions intended to induce learning"* underlines the relationship between these two significant processes in the field of education.

3. In *Psychological Foundations of Education.'* Morris L. Bigge and Maurice P. Hunt have pin-pointed the relationship between teaching and learning as established by a large member of research studies throughout the world.

Motivation

Learning is not possible without motivation. It is the task of teaching to motivate the learner to learn. The motivation may either be of the extrinsic type or of the intrinsic type. Real motivation indeed is of the intrinsic type. A critical measure or index of the success of a teacher's task of teaching is how far he has been able to induce personal involvement for learning in the learner.

Learning feeds on success, and the intermediate knowledge of progress or success spurs the learner to make additional effort to learn. It is the teacher's or the programmer's task to reinforce the learner's learning at each step so that the learner keeps on motivated to learn further and better than the previous knowledge.

Many teachers think that their class teaching in each period should end with all questions or problems solved. This is an erroneous view, since researches in modern psychology have established that the strongest motivation is provided by the motivations that are to puzzling to the learner. Hence the teacher should let some questions or problems indeed left unreplied or unsolved till the end in his class teaching. Thereby the learners remain in a tension to learn new things.

Although tests and assignments are good motivating devices in the learning process, their excessive use in likely to develop boredom in the learners and it may induce them to stop putting in earnest efforts in learning and adopting undesirable habits like copying others assignments.

Recent researches in Educational Psychology have revealed that individuals learn better and effectively when they are guided by the self-imposed goals, rather than propelled by the teacher-imposed goals.

Readiness to Learn

While it is true that modern researches have established that pupil's readiness to learn in many areas or subjects is at a much lower age than what most teachers have ever even thought of, yet more conclusive research findings are that "nothing is to be gained by starting youngsters on a particular learning task earlier than readiness normally permits."

Practice

There has been a lot of discussion on the role of practice in teaching in learning during the last several decades of the history of Educational Psychology, and most teachers have indeed been considering "giving practice" as a basic feature of good teaching.

However researches have borne out that :

(a) Merely repetition does not teach.

(a) "Mass" practice (that is, a long practice period) is less fruitful than "distributed" practice, that is, a succession of shorter period practice with rest or variety of activity spaced between.

Attention

It is an incorrect or misleading view upheld by many teachers that attention of the learners grows with age. Actually , it increases with motivation.

Part versus whole Learning

The conversy of "Part-versus-Whole learning" still continues to remain as a bugbear to most educational psychologists and teachers. Pressey's finding is that it really depends on the learners motivation as to which of these two methods of learning will prove to be effective in a particular learning situation. Pressey's another interesting finding is that learners having higher I.Q. certainly tend to learn better by the method of "whole learning" in comparison to the part learning method.

Retention

A lot of research is still going on in the area of retention or memory mechanism. There are strong research indications that in certain situations, learning can indeed be quite permanent or of a long lasting nature. It the material to be learned by learner can some-how be made meaningful to him, that is, if the learner starts seeing clear relations between facts, the retention of the part is bound to be very impressive. This again is teacher's or programmer's task to present the subject material by deploying such strategies and tactics that the learning material will ultimately cling to the learner's mind.

Modern psychological investigations have led us to the discovery that purposive forgetting and remembering are examples of "psychological homeostasis" "Through them we preserve our self-organization in a reasonably adequate state". (Bigge & Hunt.)

It has been found that over-learning does help to retain the learned things. Hence teachers must look to this important aspect also in their teaching.

Transfer of Learning

A lot of research has gone into the theme of transfer of learning. Notable findings in this area are as under:

(i) Transfer of learning can occur in many relations in any subjects.
(ii) If the teaching method is life-like, transfer of learning is bound to be impressive.
(iii) Transfer does not take place automatically. The learner must be made to know that the opportunities for such a transfer are there and the need of desire in his heart to apply his knowledge in non-conventional or other areas should be made by the teachers.
(iv) Transfer varies according to the difficulty of generalization of subject-matter and intellectual ability of individuals.
(v) Insights can be put into words for their transfer to take place.

Levels of teaching and learning situations

Teaching and learning can be organized at three levels (i) Memory level; (ii) understanding level, and (iii) reflection level.

According to Edward Tolman's model of teaching in the interactive phase of teaching, at each of these levels of teaching, both the teacher and the learners simultaneously reveal Linguistic behaviour, Performative behaviour and Expressive behaviour on the one hand, and do the actions of perception, diagnosis and reactions or achievement. Hence this model clearly establishes that teaching and learning cannot be actively insulated from each other.

Sociology of Teaching

Scholars in the Sociology of Teaching right from the Willard Waller (*Sociology of Teaching,* 1932) to Talcott Parsons through Karl Mannheim and several others, have very convincingly brought out that effective learning takes place in situations which are sociologically structured properly, in which proper socialization is carried out by right type of socializers with an adequate prior knowledge of the socializee's social, cultural, psychological and academic backgrounds. It is the teacher's task to create a healthy social climate of learning in his classroom by deploying in his teaching the numerous strategies, tactics, episodes and concepts and psychological and instructional devices including teaching machines and sociometry.

New Design of Teaching and Learning

The evolution of modern Educational Technology and its part Instructural Technology, have brought to fore the great needs of presenting before the teacher as well as the learner the specific instructional objectives of the given lesson or teaching unit, need for the teacher to assess the entering behaviour of the learner carefully and to understand and practically apply the principles of presenting in sequence small steps duly reinforced immediately at each step.

Section III. Epilogue

Although modern Educational Technologists insist that "teaching act" *per se* needs to be analyzed, yet for all practical purposes find we that it would be advantageous to study teaching and learning as close or interrelated partners. In these days of mass education, the teacher acts as a director of teaching-learning process, and it really depends upon his skills of deploying teaching strategies as to how the expected instructional objective behaviour change i.e. learning, will take place in optimum conditions.

Even modern instructional gadgetry of hardwares and softwares have not made the live teacher and his act of teaching redundent. Nothing can replace them, for the teaching behaviour of teacher indeed stirs up the whole learning situation for the learner.

Questions

1. "Teachers provide learning settings" (F.S. Divista and G.G. Thompson).
   Discuss the relationship between teaching and learning in the light of this statement.

2. In what respect can you say that teaching and learning go side by side. Give examples from actual classroom situations.

3. "Many learning principles may be of only incidental importance to a theory of teaching. Some teaching concepts and laws have no direct counterparts in learning theory." Critically discuss this statement.

4. Give five examples of feed-back that a teacher can get in organizing a specific content-structure. How can a teacher improve his teaching strategy?

5. Can you really do away with the human factor in the learning and teaching situations? Write how far it is possible.

6. Is all that is taught learnt? It not, what steps could be taken to improve this relationship between learning and teaching?

CHAPTER XI

MICRO-TEACHING

Bruce M. Shore

The relevance of many teacher-training programs is often questioned. One of the best criticisms is that student-teachers rarely spend much time actually studying teaching. One technique which can help teacher candidates learn about teaching is micro-teaching.

What exactly, are the main features of micro-teaching? How can it help achieve the goal of student teacher studying teaching?

Micro-teaching is real teaching reduced in time, number of students, and range of activities.

It was developed in 1963 at Standford University, and was used initially for the training of secondary school teachers. Five aims (described by D.W. Allen and R.J. Clark, Jr. in an article in a 1967 issue of the *High School Journal*) guided the plans for the training of teaching skills: (1) a realistic situation (2) minimum risks for both teachers and students; (3) theoretical soundness; for example numerous and distributed practice sessions, prompt feedback of results, immediate opportunity to make corrections; (4) provision of a wide range of experiences; and (5) economy in time and resources.

Applicable teaching skills include finishing lessons, responding to silence and non-verbal cues, maintaining participation, asking different kinds of questions, using good examples and using visual aids.

Micro-teaching has also been applied to in-service training (where it has great potential) to counselling skills, and to research in education. It can serve much the same function in teacher-training as the moot court does in the training of lawyers.

But let's get down to details. A typical micro-teaching sequence might be as follows. A specific teaching skill is identified, such as asking questions that go beyond facts, and stated content. The teacher creates a short lesson of about five to twenty minutes in his area of specialization, with a very specific purpose, and teaches it to about five pupils, either real students or his fellow-trainees. For example, if he is a history teacher, his micro-lesson might be about alternative causes of certain events. He could ask questions about hypothetical implications of each.

His lesson would be observed by the instructor, who might also make a videotape-recording, keeping a careful note of the trainee's use of higher-order questioning. The trainee and instructor immediately get together and review the lesson, looking at the videotape, if one was made. A chance to reteach the lesson, followed by another meeting, is usually suggested. With the student's very first micro-lesson, the feedback should focus on his strong points.

There is considerable freedom in how the micro-teaching format can be adapted to individual circumstances, and it is not expected that all teaching procedures can be taught this way.

The first question is, which skill should be emphasized? If the trainee is a new teacher who has never taught, any of the basic skills, such as eliciting the participation of pupils, could be stressed. With experienced teachers, the skills are more likely to have been chosen by the participants in some way, and to be a "refresher course," or directed to certain specific skills, such as interpreting non-verbal pupil behaviour—quite a difficult thing for someone who has had no teaching experience.

How long should the micro-lesson be? D.W. Allen and K. Ryan, in their Micro-teaching, found no differences between four and seven––minute lessons, and suggest resisting the desire for longer lessons. This is a "teacher-centred," not a "pupil-centred," technique; it is the teacher's behaviour which is of interest. Four minutes are enough for the instructor and the trainee to achieve their goals. Of course, whether the students learned what they were supposed to is a crucial test of the effectiveness of the teaching.

Micro-teaching is a way to train specific teaching skills, there is always more to good teaching than these skills themselves, but the micro-lesson is not enough of a complete lesson to make such broad judgments. This has to wait until the trainee has a real class to teach. The aim is to teach the trainee skills which he will transfer to real situations when he meets them.

An ethical problem is introduced in getting pupils to "practice on", since their learning is not the foremost purpose during the actual micro-lesson. But there are answers to this. First, the larger goal of micro-teaching is to train teachers better, with lasting effects in real teaching. Second, pupils used are often paid volunteers, quite different from the captive audiences presented to the neophyte trainee during a more usual first teaching internship. Micro-teaching was intended to precede and supplement such internships, not to replace them. All persons serving as students, real pupils, paid volunteers, psychology students, or fellow trainees are informed of their training role. Third, micro-teaching is done in the presence of a supervisor, with the exception of trainees working only with each other.

Do the effects of micro-teaching carry through to the classroom? Apparently so, if the pupils with whom the micro-teaching is done are similar to those with whom the trainee will actually work. Different pupils or the trainees' colleagues would be second choices when there are shortages of either time, money or representative students. Recent work has also shown no differences between micro-teaching and two other training frameworks, a programmed videotape, and lecture-discussion using still pictures from the videotape, in non-verbal teacher skills designed to encourage classroom interaction (e.g., eye contacts, nodding, moving towards pupils). These techniques did share the important feature of very limited purposes, very clearly defined. The proponents of micro-teaching would be quite satisfied with these results, as micro-teaching has added to the repertoire of procedures for training,

The importance of the supervision cannot be overstressed. Micro-teaching is controlled practice of very specific teaching behaviour. The choice of material and method would not be without reference to the supervisor or instructor.

All the reports on the use of micro-teaching stress the first feedback and discussion following the micro-lesson. The second micro-lesson might not always be necessary, and the videotaping is not a crucial part of the process. Videotape does provide an explicit record of a lesson, allows the collection of examples (with permission of the people filmed), and is particularly useful if students work on their own and the instructor views the videotapes at a more convenient time.

Allen and Ryan see five main advantages to micro-teaching, especially if it is a routine part of the training of teachers. First, the faculty have to get together to agree on common purposes in its use. Second, it becomes feasible to follow trainee performance closely. Third, the program is individualized and not bound by any particular "course" structure. Fourth, evidence of suitability for teaching is obtained; and fifth, it is a useful research tool.

D.G. Graig, in an article on micro-teaching in the *Agricultural Education Magazine*, added two others: it simplifies the complex teaching process in the trainees' first contacts with the tasks involved; and it is very efficient in terms of staff time, the use of real pupils, their classrooms and training facilities. Other researchers have reported that micro-teaching can achieve "similar results when compared with conventional training methods but in only one-fifth the time and with fewer administrative problems."

Finally, most reports mention that trainees' apprehension concerning their first classroom experience is greatly lessened.

What are the criticisms? W.R. Borg (Far West Laboratory for Educational Research and Development, Berkeley) and his associates have produced an alternative, really an adaptation, called Mini-course. As it has developed, the Mini-course differs from micro-teaching in four principal ways: it is a primarily an inservice, not pre-service, model; it is a self-contained package that can be used wherever videotaping is available; trainees are self-evaluated by a structured critique, not by a supervisor; and films or tapes of model lessons serve as the basis for evaluation, thereby avoiding the possible negative influences of supervisors.

There is some doubt about the seriousness of the criticisms implied in their changes. Some of their experimental results found that adding micro-teaching to mini-courses and videotaping did not lead to better performance in specified behaviours. They did find, thought, that the addition of the mini-course itself did improve performance, and that mini-course effects were more pronounced with practising teachers. There is apparently no basis in their studies for direct comparisons.

Comparisons should be based on convenience of use and availability of supervisory resources. There is much in common in the definition of specific components of teacher performance and teaching toward these goals. W.B. Borg is correct in stating that micro-teaching is not self-contained and that it relies heavily on supervisory feedback. There are surely times when these are not disadvantages; for example, in some voluntary in-service training and undisputedly, in pre-service training.

Users of micro-teaching have also been cautioned that they might get the impression that the micro-situation is the same as the real classroom. However realistic, it is not the same. Emphasis has to be explicitly on the teaching skills acquired, not on the conditions under which they were learned. Student teaching itself is the introduction to the real classroom.

It is also possible to say in criticism that skills might be taught which perpetuate obsolete practices of instruction and classroom organisation. Like any versatile technique, micro-teaching can be used to achieve undesirable goals. The individuals involved continue to have the responsibility for concentrating on relevant teacher behaviour.

In a similar vein, it is important to avoid concentrating too much on skills, such as lecturing, whose contribution to student learning is not wide.

Micro-teaching can help teacher candidates study teaching in at least five ways.

First, it views teaching as including many specific skills which can be learned individually, rather than relying on a less useful global point of view. The learning of these skills can be closely observed and assessed in terms of mastery criteria. It becomes possible to say with some certainty what the student has learned in this portion of his preparation for teaching.

Second, it is supported by a specific and growing research literature.[2] Some study of this literature could be warranted. In addition, micro-teaching itself is a useful research tool which can be used by teacher candidates to study teaching even during their training.

Learning and teaching involve very complex events. Micro-teaching is one technique which facilitates their study by providing simplified situations. It is easily used to determine, for example, which of several explanations is best understood by pupils or in what order certain topics should be taught. It is possible to try out various alternatives, With little risk or expense, and so eliminate some of the guess-work that so often confronts the teacher.

Micro-teaching is also flexible and can be altered to suit many circumstances. It can be used in internship or in-service training to strengthen particular skills. It can also be used for demonstration purposes. The presence of the instructor is not required at the time the student teachers are using it; he could view videotapes or listen to recordings later. This last point is a good example of the idea of learning how to learn, of giving students at levels techniques with which they can learn on their own. Micro-teaching, in this sense, is a good example of practising what we preach in teacher education.

Fourth, micro-teaching is not dependent on any particular facilities or equipment. The usefulness of recording facilities has been acknowledged, but the technique can be as effectively applied in the middle of a field trip without even portable equipment. The most important ingredients are the people involved.

Finally, micro-teaching focusses on teaching behaviour. This is the heart of the question of studying teaching.

References

1. Reproduced from *Education Canada*, (Vol. XII, No. 1), March 1972.
2. Many bibliographies on micro-teaching are available. An annotated one. compiled by James M. Cooper has been published by ERIC (Educational Research Information Center), Washington, D.C. Another annotated bibliography is available from the Center for Learning & Development, McGill University, Montreal. Also, the Canadian Teachers' Federation's "Bibliographies in Education Series" No. 5 is on micro-teaching.

Questions

1. Explain the significance of micro-teaching.
2. Is micro-teaching better than prosses class teaching done by teacher? If so, how?

CHAPTER XII

HISTORY OF EDUCATIONAL TECHNOLOGY

Paul Saettler

The roots of educational technology constitute two major clusters. One cluster lies in educational thought and practice of past centuries; the other cluster lies in the behavioural sciences.

It appears that the basic heritage of educational technology for Great Britain and Europe as well as for the remainder of the world is essentially similar in nature. There are, of course, some national influences of a distinctive character. For example, in Great Britain, Gordon Pask developed one of the first computer-based programmed instruction systems which was designed to adapt itself to the responses and needs of individual students. Also, the establishment of the Open University system has supplied a model to the world for alternative systems of instruction. Likewise, the systems approach is a lineal descendant of operations research and emerged in its present from during World War II, when the British High Command sought the help of teams of physicists, biologists, mathematicians and other specialists to devise strategy for incorporating advanced and unconventional equipment into the air defence system.

Our purpose in this paper is to briefly example the primary roots of this heritage and to conclude with a general appraisal. But first it seems important to provide a board definition of educational technology so that a meaningful historical context may be established.

What Educational Technology is

Much confusion as to the meaning of educational technology has brought forth a motley array of statements and definitions. The understanding of educational technology is bound inevitable to certain historical conceptions and practices. Since few educators view educational technology from all its sides, it is important to note that at least two distinct historical concepts, the physical science or device concept' and what may be called the behavioural science conception have prevailed. Although often functionally interrelated, each is an outgrowth of different theoretical notions, and each yield a different meaning and application to problems of learning and instruction. The device or machine concept predates in some respects the behavioural science view and still dominates much of the thinking about educational technology. Nevertheless, behavioural science concepts of educational technology have historical antecedents going back to ancient Greece (Saettler, 1965).

The physical science or device view of educational technology defines itself largely in terms of cardware of devices—slides projectors, television, films, cameras, cassettes, teaching machines, computers etc. Moreover, this view casts certain instructional materials (audiovisual) and machines (mention picture projectors, side projectors) in non-verbal roles and some of the traditional media (oral presentations, books) in verbal roles. The assumption underlying this view of that so-called non-verbal materials are more concrete and effective, learning process is 'verbalism'. Closely related to this view is the widely held presumption that a technology of machines is somehow equipment to a technology of instruction.

Those two support the abstract-concrete theoretical notion do not always make it clear that in denouncing verbalism they are not necessarily claiming to have found a superior alternative to verbal communication. A few extremists have, in fact, expressed the hope that audiovisual specialists might develop a completely non-verbal language for the purposes of exact communication. The very idea reflects the concept that non-verbal media offer a true alternative to either written or sooken communication and can, therefore, be used as a substitute method of instructional communication. An organisation know as the international Visual Literacy Association, for example, reflects much of this bias.

The view of educational technology held by this writer is congruent with the behavioural science view. This view is that behavioural science theory and research as well as other relevant knowledge, including the arts and the humanities, should be applied in support of the practical art of instruction. It must be stressed that this view does not necessarily imply the use of the behavioural theory of learning as may seem to think, nor does it necessarily imply an engineering view in which people and things are manipulated. The behavioural science view simply means that relevant knowledge may be utilised in some systematic fashion from the board areas of the behavioural sciences to solve problems of learning and instruction. The most important implication of this view concerns the application of such knowledge to provide a conceptual basis and methodology for the design, development and evaluation of instructional systems. Moreover, these systems may be open or closed may be designed according to the learning principal of behaviouristic, cognitive, humanistic or other theories of learning. But , in any case, any behavioural science definition of educational technology must relate to instruction as a whole and include all the essential components of the instructional process. It should also be clearly understood that educational technology is not the unique province of any one group or type of educator, but is best understood as a process applied to the problems of learning and instruction in any field of educational endeavour.

The Heritage of Educational Thought and Practice

Educational technology is basically the product of a great historical stream consisting of trial and error, long practice and imitation, and sporanic manifestations of great individual creativity and persuasion. For example, one of the most sacrosanct educational assumptions is the pupil-teacher ratio. It has withstood the repeated siege of research conclusions which suggest that there is no fixed relationship between the size of a class and how much is learned. Another example is the growing faith that individualisation is the *sine que non* of learning.

Education receives only passing reference in most of the now vast literature on technology and social change. This is perhaps the case because educational technology, by and large, has made superisingly little progress beyond the handicraft stage, whereas remarkable strides have been made in other sectors of human activity such as medicine, transportation and communications. It is true that new things have been added, and old things improved. But for the most part, these have been superimposed on instructional technologies which have prevailed for generations. Even when there appears to be a change in one dimension, close scrutiny usually reveals that the change is really superficial. For example, when television, programmed instruction or language laboratories are merely appended to traditional learning systems, they tend to perpetuate the educational *status quo*.

Most instructional television in viewed by students in a traditional classroom with a teacher present. Most educational television, is the United States, has been produced by local state agencies intimately linked with the school system. However, the introduction of 'Sesame Street' (a television series for pre-school children) in the late 1960s did more to change the traditional view of television than any of the material produced either before or after it. Generally, technological changes have had greater impact on industry than on education, and there has been hope that television, computers, and other new media could prove effective. However, with the past two decades, each new medium, offered with high hopes and great zeal, failed to achieve anticipated gains in effectiveness. Another example is school architecture. Although there have been energetic efforts to build school building more cheaply through the application of modern methods of prefabrication and modular dimensions, many of these innovations in school architecture have implicity assumed that the technologies of instruction of school will remain much the same. The concept of the self-contained classroom still prevails and is still more frequently designed, even in the newest schools, to provide for one teacher, a prescribed number of students, a cabinet for a few books, and perhaps some wall space for instructional materials. Once this building is built to education's traditional technology of instruction, it stands firmly for two or three generations as a barrier to any series changes in the traditional deployment of space, time, teachers, materials or students.

Ancestors of Educational Technology

Most important charges in educational aims and instructional practices can be attributed to particular social, political and economic influences. For example, the transformation of Athens in the fifth century BC from an agricultural society into the leading maritime power brought with it a great expansion of trade, a new class of wealthy merchants, and a new attitude toward government. These changes led to the demand for an education the would prepare young men to practise business and politics, a demand soon met by the Elder Sophists, who taught what they called the 'art of living'. They were also aware of the problems associated with human perception, motivation, individual differences, and evaluation, and they recognised that different instructional strategies were required for different behavioural outcomes. Moreover, they analysed modes of instruction and made hypotheses to take into account the factors disclosed by their analysis, just as contemporary researches are doing today. The Elder Sophists appear to be the real ancestors of modern educational technology because they were probably the first professional teachers, who, by their organisation of instructional materials, laid the ground work for the first prototype of a technology of instruction. Moreover, the Sophists viewed technology or techne as combining the theoretical with the practical.

The growth of knowledge in the seventeenth century led Johann Comenius (1590-1670) to envision a system of instruction whereby learners would be led inductively to generalised knowledge by working the natural objects and studying practical things. Comenius was the author of over a hundred textbooks for children, among them *Janua Linguarum Reserats or Ga e of Languages Unlocked* (1631) the first Latin grammar children, and the Palatium or the The saurus, excerpts from classical authors to be used as readers. Although his textbooks were adopted or initiated all over Europe, his theoretical writings remained virtually unknown until the nineteenth century. On the basis of these convictions Comenius anticipated many of the germinal concepts of contemporary educational technology. His *Orbus Pictus* (1657), probably the first illustrated textbook for children, combined pictures with narrative and became an integral part of the instructional process. But even as Comenius developed this and other new forms of instruction, he expressed doubt concerning their acceptance. He said.

> Who will have faith in these things before he sees them? It is a well-known peculiarity of men that before a remarkable discovery is made, they wonder how it can be possible, while after its achievement they are surprised that it was not discovered before (Comenius, 1896).

Before the nineteenth century, instruction was essentially that of strict recitation of matters learned entirely by rote. This was in accord with the dominant theory that children were innately evil and that their natures had to be broken and brought into complete subjection. However, there were some early forerunners of modern educational technology whose ideals and ideas were far ahead of prevailing educational practices of the time. Some of the more notable of these were Jean Rousseau (1712-1778), John Locke (1632-1764), Johann Pestalozzi (1746-1827), Friedrick Fortbel (1782-1852) and Johann Herbart (1776-1841). According to Locke, child nature was respected and accepted, but something that had to be moulded and shaped by an adult. With Rousseau, child nature was enthroned; the child could do no wrong as long as he remained his true, natural self. Object teaching as developed by Pestalozzi and Fraebal went beyond mere practice and shifted talk to theoretical considerations. In Herbert, there was a more advanced return to methods similar to those of the Elder Sophists. Instruction became highly systematised and cognitive elements came into central focus in the instructional process.

Development of a Science of Education

In the early years of this century, American educators looked to the development of a science of education. Edward Thorndike (1874-1949) was the exemplar of what could be done by empirical-inductive means. Thorndike did research on school learning and attempted to solve the problems that educators of his day thought important. He fashioned the learning theory of connection is and it dominated educational thinking for many years. John Dewey (1859-1952) also rose to eminence during this period, and for time both he and Thorn like were pitted against the unscientific modes of thinking prevalent in their day. But Dewey is philosopher developed a comprehensive theoretical system, ranging from the nature of man and learning of ethical and logical theory. Interestingly, Dewey, the pragmatist, the founder of the experimentalist school, built a system that had little grounding in data and whose hypotheses to this day remain untested. By the time of World War 1, Thorndike had produced his major volumes on educational psychology and Dewey had written *Democracy and Education,* (1961). The old theories, primarily theories stemming from philosophical sources had been demolished and the scientific study of education had been firmly established. And, simultaneously, a new theoretical basis and methodology had been inherited by educational technology. Dewey's contribution to technology of instruction was his conception of instruction in terms of scientific method. The essence of this so called reflective method is contained in his little book, *How We Think,* (1910).

During World War I, The testing movement began quite successfully, but was soon disrupted when the test data introduced the controversial results which showed that the average mental age of the American soldier was fourteen and that test differences were along ethnic lines. Meanwhile, there began an era of conflicting psychologies of learning, essentially between the newly introduced

Gestalt psychology and behaviourism, which raged throughout the 1930s, with the beginning of World War II, a closer relationship began to develop between educational technology and psychology which set the sence for the emergence of a technology of instruction based on the application of the behavioural sciences to problems of learning and instruction. Our discussion of this development will be reserved for a later section in this paper.

Applications of Physical Science Technology in Instruction.

The origins of instructional devices can be traced at least to the development of writing surfaces. The earliest of these, dating from the fifteenth century BC, is a small flat, rectangular piece of stone found at Thera and described as the 'earliest example of the present-day slate used by school children on which they scratched designed and learned their first letters' (Havelock, 1971).

As late as the fourteenth century, instruction was conducted almost entirely by mouth. The teacher would read from a manuscript, and the students would memorise much of what he said. But even after printing was invented in the mid-fifteenth century the printing of more than one thousand copies of a book was a rare event. The market was extremely limited and the only products early printers could count on for profitable returns were the Bible, Donatus' grammar and prayer books. It was almost a century after the invention of printing that Pater Ramus (1515-1572) led his successful reform movement in higher education towards a new dependency upon printed books. Schools began to be seen as one of the primary markets for the press, and when university professors began to write books for classroom instruction, books increasingly became the medium through which all experience had to pass before it became available for use in intelligent action (Taylor and Arlt. 1941). The publication of textbooks altered both the conception of education and the patterns of instruction. Whereas before, there had been a single source of information for an entire class of students, namely the teacher, there were now as many sources of information as there were books available. Moreover, printed books made possible the introduction of organised learning and education to masses of people, instead of to a limited few.

It seems important that from its earliest beginnings the written world never has been completely separated from graphic and pictorial illustration. Just as non-verbal gestures and expressive movements and meaning to the spoken word, so do pictures and other illustrative material bring meaning to the written word. However, the relative significance of non-verbal material in books for different educational purposes and the design and arrangement of verbal-illustrative materials ore still open questions.

Until relatively recent times, classroom instrumentation was meagre. The main instruments were a blackboard and chalk and the writing materials on the desk. Nevertheless, the industrial revolution did provide an unending series of inventions of better writing and drawing instruments and writing surfaces, books, form boards, charts, number blocks, models, maps globes and so on, culminating in innovative mechanical devices for teaching spelling, reading and arithmetic. Some of these instruments persist today, not so much as instructional aids but as educational, toys for children. One of them, for example the rotating speller, was the precursor of one of the most widely used scientific instruments of psychology, the memory drum. Of all the developments in the last century, modern methods of reproducing visual and authority material have had the greatest impact on teaching techniques. Until the middle of the nineteenth century, pictorial displays could be reproduced only by hand reproduction, printing or drawing apparatus. The invention of photography brought with it a simple and inexpensive method of pictorialising instructional materials.

The technological advance of photography was augmented by the capability of using projected pictures through the development of various forms of slide or transparency projectors, the camera lucida, and the opaque projectors. Later came sound recording, silent and sound synchronised motion pictures, and quite recently, the electronic transmission of television. Computers and other automata, such as cable television, video recorders and communications satellites pushed the communications frontiers even further.

The Emergence of Visual Instructions

The plethora of devices which had developed in the 1875-1925 period brought forth a physical science conception of technology in instruction. In the early decades of this century, small groups of educators in the United States formed associations which featured the words 'visual instructions' or 'visual education' stressing the pictorial content as opposed to the verbal emphasis of lectures and books. An early abstract-concrete continuum designed to serve as a guide to instruction appeared in Exposition and illustration Teaching, written in 1910 by John Adams. Adams explained that an 'order of merit' should be followed in instruction as follows: (1) the real object, for which anything else is more or less an inefficient substitute. (2) a model of the real object, (3) a diagram dealing with some of the aspects of the object and (4) a mere verbal discription of the object (Adams, 1910). Weber, (1928) developed a more elaborate scheme in 1928 with Dale, (1954) following after World War II with a similar theoretical rationale in his cone of experience.

Despite such theorisation, such concepts seem to have been introduced more as a *post hoc* rationalisation for visual introduction (later called audiovisual instruction) than as a direct influence on the design and development of instructional materials. It is clear that the development of motion pictures and television occurred almost entirely without reference to education or learning theory. Historically, audiovisual materials have been used primarily for group or mass presentations without explicit regard to individual references in learning ability. Traditionally, the roles of instructional films have been seen as aids to teaching rather than as self-contained sequences of instruction.

In the forties, this field became known as audiovisual instruction. However, by the early 1960s' it was becoming increasingly evident that there was a growing dissatisfaction with the physical science or thing-object orientation of the field. By the 1970s, the dominant term became 'educational technology'. Still, there were many who resisted this term and felt that the words 'communication' and 'learning' or resources' (as a substitute for 'aids') should replace the old audiovisual term. Finally, a compromise was reached and the professional organisation of the field in the USA came to be known as the Association for Educational Communication and Technology.

Relationship of the Audiovisual Movement to Educational Technology

A rarely made historical distinction needs to be drawn between the audiovisual movement, whose traditional, primary concern has been with the use of specific media, and a technology of instruction which is primarily oriented towards psychological data based on the total teaching-learning process. As we have seen, the history and tradition of educational technology reaches back to the Elder Sophists. On the other hand, the audiovisual instruction movement was a relatively late development of this century and emerged as a small, specialised movement almost completely separated from the traditional mainstream of educational technology.

Although the audiovisual movement has been little affected by learning or communication theory, or by theories of group process, social change, innovation and diffusion, it does have a research tradition. This tradition has consisted largely of experimental comparisons of different treatments, such as film v. print v. live teachers, etc. The overwhelming result of this research is that 'no significant differences were found among the groups'. Moreover, if communications media are having an effect on educational programmes, it is not evident. Oettinger concludes that 'learning as now measured is largely independent of the details of means' (Oettinger, 1971).

This discontinuity of the audiovisual movement with a technology of instruction can probably best be illustrated by developments in programmed instruction. For example, Maria Montessori (1870-1852) began one of the first systematic attempts to implement a psychological theory in the design of a programmed apparatus in 1907, which was just about the time the visual instruction movement was beginning to germinate (Montessori, 1912). About 1925, Sidney L. Pressev and others began their experiments in programmed instruction. Yet for four decades or more, there was no connection between the audiovisual movement and this significant development in educational technology. The contrast between the audiovisual movement and behavioural science conception of the educational technology is even more striking in that the AV movement has generally ignored psychological theory and individual differences in learning ability. On the other hand, a technology of instruction in its traditional orientation has stressed the importance of psychological theory and empirical data. Moreover, it is a process which draws on research in a wide range of study such as psychology, anthropology, sociology and linguistics, in order to design, execute and evaluate an integrated and comprehensive instructional programme to achieve specific learning objectives. Going beyond the physical science conception which has been dominant in the audiovisual movement, such a programme employs a range of strategies, including the use of teachers, textbooks, specially designed classrooms, and communications media, in order to ensure that each student learns as much as he can in each area of subject matter. In other words, a technology of instruction implies the design and continuous revision of total instructional programmes or 'systems' rather than the grafting of isolated innovation onto existing practices.

Contributions of the Behavioural Sciences

The relationship between the behavioural sciences and educational technology has been somewhat tenuous during the first half of this century, but the connections have taken a firmer hold in more recent years. As we have seen, Edward Thorndike was the precursor of the modern behavioural science concept of educational technology. An example of his prophetic insights appeared in 1912 as follows:

> If, by a miracle of mechanical ingenuity, a book could be so arranged that only to him who had done what was directed on page one would page two become visible, and so on, much that now requires personal instruction could be managed by print. Book to be given out in loose sheets, a page or so at a time and books arranged so that the student only suffers if he misuses them, should be worked in many subjects (Thorndike, 1912).

Thorndike influenced the work of W.W. Charters, Douglas Waples and *Fanklin Bobbitt*. The influential and massive *Commonwealth Teaching Training Study*, (1929), financed by the Commonwealth Fund and directed by Charters and Waples of the University of Chicago, was intended to produce a scientific and systematic basis for a 'radical reorganisation' of existing teacher-training curricula. Their approach, know as 'job analysis', was linked to the development of business efficiency and management systems (Charters and Waples, 1929).

Another major theme in the 1920s was the demand for-specific objectives. This was exemplified in the work of Franklin Bobbitt, who advocated a curriculum built on them. Meanwhile, a new instructional technique was devised by Carleton W. Washburne, superintendent of the Winnetka, Illinois Public Schools in 1919. The significance of the Winnetka Plan lay in its attempt to provide for individual differences in learning and at the same time, teach specific, clearly identifiable objectives (Washburne and Marland, 1963). Thus, the meaning of educational technology was expanded and came to be understood as a process whereby instructional methodology based upon scientific principles derived from the behavioural sciences (particularly from psychological learning theory). It also began to imply a systematic approach to the problems of learning and instruction.

Still another important development, probably one of the most important early developments which brought about a closer relationship between the behavioural sciences and educational technology, was the beginning of programmed instruction. Although Sidney L. Pressey is usually given the credit for pioneering this development, is was actually Matia Montessori who should be given it. Pressey did device a testing system that provided automatic scoring of multiple-choice tests. His prim aim was to construct a device which could relive the drudgery of teachers correcting test papers. But like so many labour-saving inventions, it appeared at the wrong time. Not only was progressive education at its peak of popularity, but unemployment made people suspicious of any plan to save labour through automation.

Development of Programmed Instruction

A generation later, programmed instruction was received and revised in the work and writing of Crowder, (1960) and Skinner, (1968). Skinner's method of linear programming embodies the principles of 'operant conditioning' which he discovered in the course of fundamental research into learning. Crowder's method of branching programming was based on his practical work in the armed forces of industry—therefore on applied rather than pure research. Whereas Skinner sought to apply what he had found in the laboratory, Crowder set out the automate the behaviour of human instructions as he observed them. The linear and branching methods are the dominant ones in programmed instruction (though not the only possible modes of programming) and all important controversies in this field have centred on them.

The Cybernetics Tradition

The development of the science and technology of control systems reveals some interesting parallels between electro-mechanical controlling devices and living organisms. Shortly before and during World War II, it became increasingly apparent to behavioural scientists, engineers, mathematicians, and other that the exploration of control problems in devices held a particular significance. One of the first publications outlining this new field of theory and research war Wiener's Cybernetics, (1948). The ideas expressed reflected a variety of sources, including training psychology and human engineering of the war years when many of the problems of man-machine control system were first formulated.

The application of cybernetic principles to education was first systematically developed by Gordon Pask with the introduction of his so-called adaptive teaching systems in England in 1953 (Lewis and Pask, 1966). This was the first of many steps toward a computer-based instructional system. The subsequent development of computer-assisted instruction (CAI) in the sixties brought about a new science and technology of instruction, but the high expectations did not materialise in the seventies because CAI had been oversold and the complexity of mastering its technology was greatly under estimated. Nevertheless, CAI could be seen as similar to the invention of printing because it represented a new breakthrough of equal social and intellectual significance. For as long as individualisation is a valid educational goal, the instructional potential of CAI is tremendous. Today, the majority of CAI system in the United States are research projects, although a significant number of students are now receiving some of their instruction under CAI from such systems as the IBM 1500.

Further computer-based influences have come from the field of artificial intelligence. From this point the relationship between student and teaching system is seen as symbiotic; the teaching system seeks to understand the student just as he tries to understand the teacher. The two need to be effectively coupled and this leads to a further relevant discipline, that of ergonomic of the study of man-machine systems. The term 'ergonomics' was devised at Oxford in 1949 and denotes the science of work the study of a specific kind of behaviour: that of a man-making a programmed physical or mental effort in return for some remuneration. In the board sense, ergonomics covers the psychology of work, in its restricted sense, the technology of communications within a man-machine system.

Another influence of educational technology related to the general area of cybernetics is gaming and simulation. Simulation refers to a group of activities in which direct observation of the real situation may be difficult or even threatening. Therefore, an artificial situation which models the real situation is created. Games have had a well-established role in education, but their systematic use in the training of high-level skills is fairly recent. It is not only the knowledge of how to use computers, but the new knowledge brought by instructional science, that challenges educational technology. The development of CAI systems for the future promises profound implication for educational technology.

Much of the work of Gordon Pask is based on a comprehensive cybernetic theory on efforts some provocative possibilities for the future for CAI or Cybernetic theory and Methodology (pask, 1975, b).

Communication Theory and Research

While the contribution of the behavioural scientists provided relational for educational technology, communication theorists offered a focus on the process of communication. Lasswell (1958) proposed that communication theory and research are connected with who says what through what channels to whom with what effect. Other theoretical contributions have been made to educational technology. Specifically, Leon Festinger's extremely fruitful work on cognitive dissonance, Carl Hovland's monumental studies of persuasibility, the theories and experimental work of George Herbert Mead, M. Brewster Smith, Albert Mehrabian, H. C. Kelman, Colin Cherry, Katz and Lazarsfeld, Susanne Langer, Rusch and Bateson, I.A. Richards, the 'General Semanticists', Edward T. Hall, Marshall McLuhan, and others (Olseon, 1974).

The concepts of communication theory and research helped educational technology move in new directions, although their connection with educational technology did not really begin until the late forties. The psychology and sociology of communication reached their most fertile period during the fifties. The political and ethical implications of mass communications to war some years after World War II, when historians began to explore the extraordinary propaganda uses of print, and films made during the war years.

Instructional Theory and Research

It is clear that there began to emerge in the fifties a group of positions in educational technology which came to be known as instructional theories or, in other words, an integrated set of principles prescribing guidelines for certain educational conditions. Another development during this period was the emergence of human factor approaches to the utilisation of behavioural science research in the development of man-machine systems. About this same time, there also developed an interest in the application of social psychology to problems of intergroup relations. During the sixties, other voices were heard. One of the vocal advocates of a theory of instruction was Jerome Bruner of the Harvard Centre for Cognitive Studies (Burner, 1966). In a series of books and papers, he took the position that while learning and developmental theories can make their contribution, there must exist in addition a theory of instruction as a guide to educational technology. B.F. Skinner consistently urged a direct study of individual learners for the purpose of developing a behavioural science technology of instruction or teaching (Skinner, 1973). Robert Glaser presented many papers in which he called for the development of principles of instruction based on direct investigations of training and instructional situations (Glaser, 1966). Ausubel used cognitive theory as a point of departure in stating that we need to develop theories of instruction for a science and technology of instruction (Ausubel, 1967).

Since the middle of this century, for general developments have occurred with illustrate the increasing development of a behavioural science of educational technology. The first development, which we have already discussed, was that of programmed instruction, stimulated in recent years by Skinner and his associates. Controversy continues as to whether the behaviour-modification approach can deal with all the educational objectives considered important in our society. Moreover, other resist the idea of stating educational objectives in explicit, behavioural terms. But one of associated effects of this movement was the application of the concept of accountability in educational practice. A second significant development was the growth of systems specifically designed to describe what teachers and students do in classroom situations. It is noteworthy that approximately 70 such systems were developed during the 1960-70 decades.

The third important development came from those educators (traditionally called audiovisuals) who had been primarily concerned with devices and who had traditionally shunned the theories and principles of a behavioural science technology of instruction. These groups have, as we have seen, been identified by a number of different names throughout the past decades of this century. In more recent years, the term educational or instructional media began to replace visual or audiovisual aids or materials. As a consequence, the audiovisual tributary, which had left the mainstream of educational technology in the early of this century, tended to flow back to its source.

The fourth development leading toward a more fully developed or mature behavioural science educational technology was the curriculum reform movement and the development of curriculum theory and instructional theory. Though there have been numerous groups concerned with the theory, design, and improvement of instruction, the Association for Curriculum Development (ASCD), beginning in the early sixties, has been particularly concerned with development of instructional theories. Many point to R.W. Tyler's work in the thirties as having anticipated much of this current concern with scientific theories of instruction. Interest among ASCD members was certainly simulated by Bruner in recent years. In any event, interest in scientifically tested and systematically developed instructional theories has continued into the seventies.

A fifth and counter development to much of the foregoing has emerged during the past few decades and has come to be known as humanistic psychology (Maslow, 1968). Some contend that it should be considered as an alternative both to neobehaviourism and to contemporary psycho-analytic theory. In brief, most humanistic psychologists contend that learning theories involve a conception of psychology modelled on the physical sciences. That is they are concerned with describing man's behaviour from the viewpoint of the person rather than from that of an observer.

Appraisal and Prospects

An attempt has been made to identify and trace the diverse roots of educational technology. Some new roots have spread while others have withered or stopped growing altogether. Undoubtedly, newer roots will eventually emerge and reach out in new directions. Without question, the behavioural science branch appears to be increasingly dominant and to have excellent prospects for further growth.

Nevertheless, there are some concerns about future prospects. It seems to this writer that behavioural engineering is far too narrow to be a true technology of instruction. The snapping of a student's behaviour by means of the careful arrangement of contingencies of reinforcement is one of many methods that may be used for different kinds of learners, by different types of teachers for a limited range of purposes, and for certain kinds of subject-matter. A true technology of instruction must be based on research that takes into consideration all these and other variables and interactions.

We must not be misled by behaviourist rhetoric which asserts that 'when it finds its most effective methods, education will be most uniquely relevant to the task of setting up and maintaining a better way of life' (Skinner 1973). The most effective method of changing beliefs, attitudes, and behaviour may not be the most ethical one. In Skinner's analysis, a 'better way of life' can only be one which enables an individual or culture to survive. But survival in no way ensures that one will live well. The process of educational technology must not be guided solely by the criterion of efficiency, but by our highest ideals of education as a means of dealing with the whole person rather than with some kind of 'fragmented', reductionistic' analysis of all the sub-aspects of man. In other words, educational technology, in the writer's view, should contribute to the overall self-fulfilment of the individual.

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APPENDIX II

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